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The ELECTRICAL REVIEW

FOUNDED 1872

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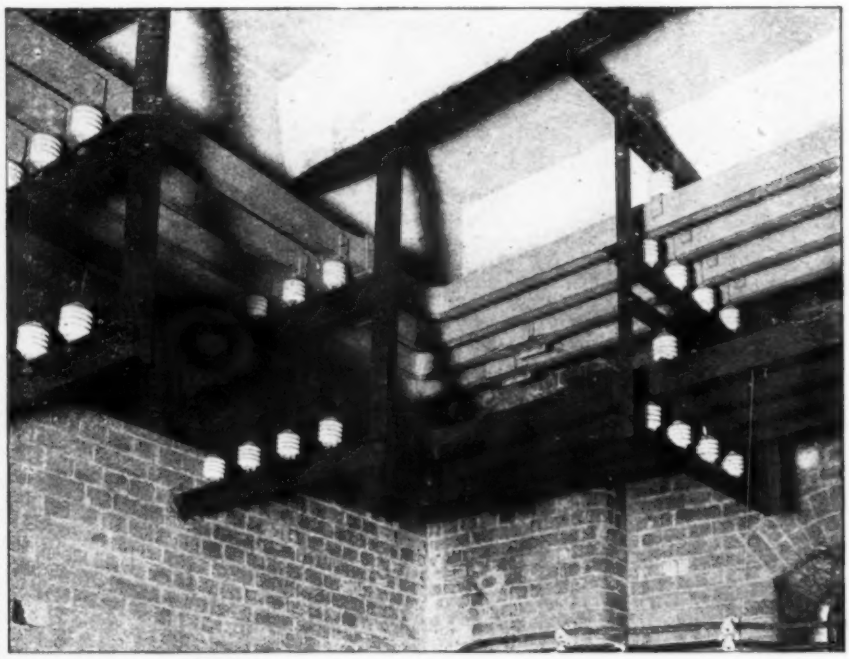

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The

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Electricity Supply Tariffs.

THE subject of tariffs is one that we have always with us; its importance cannot be denied, for the whole business of public electricity supply pivots upon it. Yet the perfect system of charging for electrical energy remains undiscovered, though so many able men have wrestled with the problem during the past forty years—and it never will be discovered, for the number of independent variables involved is infinite, and the conditions are constantly changing, even in the case of an individual consumer. The aim of tariff-makers has generally been to deal justly with every customer, a purpose laudable enough, but impossible of attainment, even if a separate tariff were devised for each; it illustrates again the circumstance that the supply of electricity was begun and has been carried on not by business men but by engineers, whose whole training has imbued them with an ingrained devotion to accuracy, so that to their mentality rough approximation is repellent.

But "business is business," and salesmanship is the soul of it; if it is to be carried on successfully sound commercial methods must be adopted, and the abstract justice of the technician must give way to expediency. It has been aptly pointed out that the Post Office charges three times as much to carry a letter as it does in the case of a newspaper—yet nobody complains; water is supplied to all domestic consumers, regardless of the amount consumed, at a flat rate assessed on a purely arbitrary basis, and the public is quite happy about it. Granted that the supply of electricity from a technical point of view is like no other public service—nevertheless, from a commercial point of view it must be dealt

with on lines which put no strain on the credulity or the comprehension of the user, and which differ as little as possible from those followed in respect of other commodities. Simplicity is the keynote, and intelligibility an essential feature, of a sound tariff.

It has often been prophesied that the time will come when it will no longer be necessary to have regard to the use to which the supply is put—that lighting will be merged in the aggregate of domestic and other uses, and will no longer call for discrimination in the tariff. Has not that time arrived? Doubtless not, if we think only in flat rates, as some do still, even in London; but progressive undertakings have long passed that primitive stage.

The domestic consumer, of course, whom we expect to exercise so profound an influence on the development of electricity supply, is the focus of discussions on tariffs—the larger consumers, such as factories, hotels, &c., can be dealt with individually, if necessary, and as equitably as the engineer could wish. In our opinion the case of the former should be met with a single meter, and the tariff should cover all uses without discrimination. That can be done with a two-part tariff—a fixed quarterly or annual payment and a small charge per kWh. Moreover, the fixed payment should not be based upon the aggregate wattage of consuming apparatus installed—a most unfair method, in view of the diversity factor obtained—but upon some basis as arbitrary as that of the water rate, whether it be rateable value, floor surface, or what not. To restrict the installation of domestic consuming apparatus by such means is surely, to say the least, unfortunate when we are all shouting for the development of the domestic load.

The authors of the papers on tariffs that were read before the Institution of Electrical Engineers at a recent meeting, which are abstracted elsewhere in this issue, have done good service; it is well that the subject should be critically examined from time to time, and important that it should be discussed in open meeting, for as we have said above, there are not a few suppliers of electricity who appear to be still in the dark ages and need enlightenment. But we cordially agree with Lt.-Col. W. A. Vignoles—who has done such good work in this connection—that we must *sell electricity*, with a plain two-part tariff and one meter. Other speakers supported his views. Absolute equity is unattainable: commonsense methods must prevail. And by "selling electricity" we do not mean providing a supply and waiting for customers to ask for it; we mean purposeful effort to induce people to accept it—canvassing, advertising, pushing the sale, in the homes not only of those who are not yet on the mains, but with even better prospects in houses and shops where some use is already made of it. The soil is fertile; it only needs tilling and sowing to produce an abundant harvest.

An Advisory Committee on Domestic Supplies.

Since writing the foregoing we have received from the Electricity Commission a most welcome announcement, reported elsewhere in this issue, regarding the appointment of an "Advisory Committee on Domestic Supplies and Methods of Charge," composed of men of unexceptionable competence to deal with the questions referred to them—namely, methods of developing the domestic uses of electricity; better systems of charging for domestic supplies than the statutory *pro rata* method; and legislative measures that may be necessary to give effect to the committee's conclusions.

We venture to congratulate the Commissioners on their opportune action, which we hope will be fruitful in substituting a definite progressive policy for the divided counsels which have hitherto prevailed. In their last annual report the Commissioners dealt at some length with the very few applications which had been made to them under the Act of 1922 for permission to supersede the flat rate, and explained the difficulties that arose. We are glad that the matter is not to rest there, and that the whole question of domestic supply development is to be thoroughly investigated. Papers, lectures, and discussions are useful and instructive, but a systematic review of the subject, leading to definite recommendations and positive action, will be far more effective.

It will be noticed that whereas at first the Commissioners were fully occupied with the reorganisation and administration of electricity supply mainly in respect of generation, they recently took up the question of transmission and distribution, and appointed a small Advisory Committee to assist them; and now they are attacking the problem of consumption. The machinery, in fact, is being brought into full running order. There remains a vast amount of work to be done—all that has already been accomplished is only preparatory—but we are approaching the "production" stage, and the staff of the industry is working with zeal and energy to tune the plant up to the top note of efficiency.

Costs of Production.

The loss of the contract for the building of motor ships, placed in Germany at prices which British manufacturers could not touch, is a large and spectacular example of what may be expected unless adequate and speedy measures are taken to deal with the situation.

A useful and timely letter from the pen of Sir Philip Dawson, who has recently toured the Continent, appeared in *The Times* of April 2nd. One of the points to which attention is drawn is the need for the electrification of our railways. In this connection it may be noted that the policies of the railway groups are as diverse as they can possibly be. There is a complete lack of uniformity of plan as between one group and another. So far as the indications that are allowed to reach the public eye take one, the subject of electrification might never have been spoken of by one general manager to another, or by a director of one group to a director of another group. The London, Midland and Scottish Railway has just separated its electrical side completely from the mechanical department by which it has been controlled since the amalgamation of the railways forming the group. We are glad to see this, and hope it may herald a rapid advance of that railway in the direction of further electrification. The Great Western Railway, however, since the retirement of Mr. Roger T. Smith, has placed its electrical department under the control of the mechanical engineering department; and we believe that on the London and North-Eastern Railway the same is the case. The most progressive line, from the electrification point of view, is the much-vilified Southern Railway, though it is a melancholy fact that the "improvements" effected seem to leave some of the suburban stations worse off than before as regards the time table. But this is a digression from the subject in hand: there is one part of Sir Philip Dawson's letter to which we should like to direct the special attention of those interested, as it is, in our opinion, the most important of all. Dealing with the motor ship contract, to which reference has already been made, Sir Philip says:—

"The causes which enabled the Deutsche Werft to quote such a low price were not mainly longer hours and lower wages, but the fact that the plant has been designed and installed under the most favourable conditions since the war for the special purpose of producing definite types of ships, thus rendering standardisation practically possible. The management is very able and has special knowledge of motor-driven ships. The yard co-operates with works which are experts in the production of Diesel engines on a large scale and with those who produce all the component parts of iron and steel from the raw material and deliver these ready for assembling to the shipyard. Efficiency is the Germans' motto. Recently I saw works where modern plant had just been replaced, with the result that with an increased output the number of men employed had been reduced from 1,050 to 750."

There you have it. With modern equipment, and with "efficiency" for the motto, great results may be achieved. Let the British manufacturer make up his mind that, before everything else, it is necessary to have the very best equipment, and to specialise. There is far too much fear of the scrap-heap, which is really a

most wholesome and curative institution. There must be countless cases within the personal knowledge of our readers where existing plant, which performs its function, but is far from modern, is allowed to continue in operation long after its economic life is finished; or where there is antipathy to the removal of small and inadequate buildings which make it difficult to erect modern shops.

In America, as has long been known, it is common practice to replace the old by the new, and the new by the still newer, directly it is seen that such a step will improve manufacturing possibilities. Now, as Sir Philip Dawson and others are pointing out, the same practice is becoming usual on the Continent. It therefore seems as clear as anything can be that if we are to keep ahead, or even abreast, of other nations, we shall have to see to it that our equipment and our methods are brought, and kept, right up to date.

One way of reducing the costs of production is outlined by a contributor in an interesting article which appears elsewhere in this issue—namely, by co-operative specialisation and organisation of the manufacturing industry. The idea is not new to our pages; from time to time during the past quarter of a century we have drawn attention to the waste and inefficiency resulting from the manufacture of too many different types and sizes of machines in a single factory, and some British firms which adopted the policy of concentration on a strictly limited range of products have proved the soundness of that policy. No doubt there are immense difficulties in the way of such organisation as the author advocates; on the other hand, some of the obstacles which formerly existed have been removed by the process of evolution which follows increased demand, and from a purely technical point of view the problem is much more simple than it was ten or twenty years ago. The necessity of cheapening production is so urgent that no reasonable proposition should be neglected, and we therefore commend the article to the earnest consideration of our readers.

Export Trade and Home Electrical Development.

ATTENTION may be directed to the remarks on export trade and production costs contained in the speech of Sir Philip Nash at the Metropolitan-Vickers annual meeting, reported elsewhere in this issue. He stated that about 50 per cent. of the business passing through the company's works was for export; "in other words, every other employé . . . is deriving his living from work obtained outside Great Britain." He predicted that, unless the cost of products can be kept down, the present large volume of export trade must grow less, and fewer workpeople will be employed. Speaking of the relation of electrical development to the condition of our general industries, Sir Philip remarked that there was no country which needed electrical development more than our own as one of the means of reducing the cost of production in those industries and as an important factor to ensure successful competition in foreign markets. The figures given in the speech of the comparative electrical forwardness or backwardness of specified countries emphasise once more the enormous scope that lies before British electrical industry, while the reference to the great need for closer and more enthusiastic co-operation between our manufacturers and supply authorities in popularising the domestic applications of electricity, though it is so familiar, calls attention to a matter concerning which enterprising joint action ought not to be any longer delayed.

Trade with Chile.

THE report of the British Commercial Secretary at Santiago (Mr. W. F. Vaughan Scott), which we review elsewhere in this issue, contains a number of matters of interest to British electrical manufacturers and traders. Mr. Scott not only indicates several openings for trade, but also from his personal knowledge of the market instructs aspirants to Chilean custom how to set about to obtain it.

He shows that only a small proportion of the large water-power resources has been harnessed up to the present, and expresses the opinion that development will increase. Each stage of development means a large demand both for the generating plant itself and for apparatus to consume the energy produced. Railway electrification is being actively pursued, and there is scope for tramway improvements in a number of the larger cities of the country. In another direction, the advent of radio broadcasting has been welcomed by the public, and there is a great potential demand for receiving apparatus. There is evidence in the report that the United States and Germany are redoubtable competitors in the electrical as in other branches. In 1922 the British Empire's share of the Chilean import trade fell to 26 per cent. from 35 per cent. in 1921. At the same time the American proportion remained at 27 per cent., while Germany's share rose from 9 to 14 per cent. The drawing of general conclusions from these figures is, however, difficult, as the fluctuations during the past twelve years or so have been very violent.

One section of the report is a kind of "straight talk" to British traders. It is stated that they are too much inclined to rely on the good name of British manufacturers to do their selling for them. Mr. Scott emphatically declares that this is not enough; goods must be properly advertised, and, moreover, better methods must be adopted. The question of language, which is constantly recurring in connection with Latin America, is again mentioned. It is essential that representatives, in addition to possessing adequate technical knowledge, should speak Spanish, and that catalogues should be printed in that language and metric measures used. These matters have been stressed on so many previous occasions that we hope British manufacturers by this time will have taken steps to remove the causes of complaint to their own advantage and that of British trade with South America as a whole.

The Shannon Hydro-electric Scheme.

THE Government of the Irish Free State is pressing on with the preliminaries of the German scheme for harnessing the River Shannon; having obtained the approval of the Dail, it will shortly introduce a Bill to enable it to proceed with the project as a State undertaking, which is expected to meet with little opposition. The next stage will require a few months' preparation, as it is believed that a second Bill will be introduced to set up a Board of Control and to endow it with the necessary powers.

In the meantime the Government's policy is being severely criticised on the score of its refusal to publish the plans and estimates of the German company, or to admit competitive tenders; Irish engineering opinion is unanimously hostile to the scheme, and in the *Irish Builder and Engineer* for April 4th, articles were published by Mr. T. Tomlinson, M.I.E.E., who for many years has earnestly advocated the gradual development of Irish water power, and Mr. A. E. Porte, M.Inst.C.E.I., the former adversely criticising the scheme in detail, and the latter emphasising "the necessity for most careful and searching inquiry before the Free State is in any way committed" to the German proposals. As Mr. Porte points out, it is strange that efforts should be made to stampede the country into acceptance of this scheme, whilst three other Irish schemes are still *sub judice*. Apart from engineering views, public opinion regards it as very questionable whether the Government should expend so large a sum of money on so nebulous a project, without competitive tenders, and without giving a chance to British firms, although this country is the Free State's best customer, taking 95 per cent. of its products. The whole affair is being handled in an extraordinarily unbusinesslike way, as though a sudden infatuation had seized the Government and was impelling it onwards in a mad rush to what, we fear, will prove to be inevitable disaster.

E

Electricity Supply at Tunbridge Wells.

Inauguration of New Generating Plant.

The Borough of Royal Tunbridge Wells commenced a public supply of electricity in 1895, the system being single-phase a.c. at 67.5 cycles, and the generated pressure of 2,000 volts was transformed in distributing sub-stations to 220 volts. The plant was added to from time to time, the first turbo-alternator having been installed in 1910, and in 1923 the total capacity of the undertaking was 2,200 kW.

In that year a scheme of extension was adopted which involved a change over to modern conditions of operation and the scrapping of the old plant, with the exception of a 16,000-lb. B. & W. water-tube boiler and a 1,000-kW G.E.C. turbo-generator installed in 1922; the latter has been modified to suit the new conditions, and will act mainly as a stand-by set. The final installation will consist of three 3,000-kW and two 1,500-kW, a.c., 6,600-V, 3-phase, 50-cycle generating sets with six boilers of 25,000 lb. of steam capacity each at a pressure of 250 lb. per sq. in. and a total temperature of 656 deg. F.

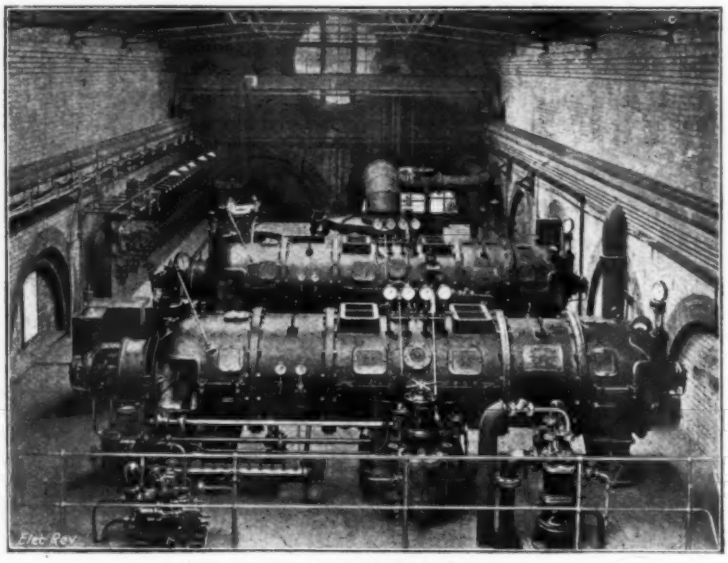


Fig. 1.—New 1,500-kW Turbo-Generators.

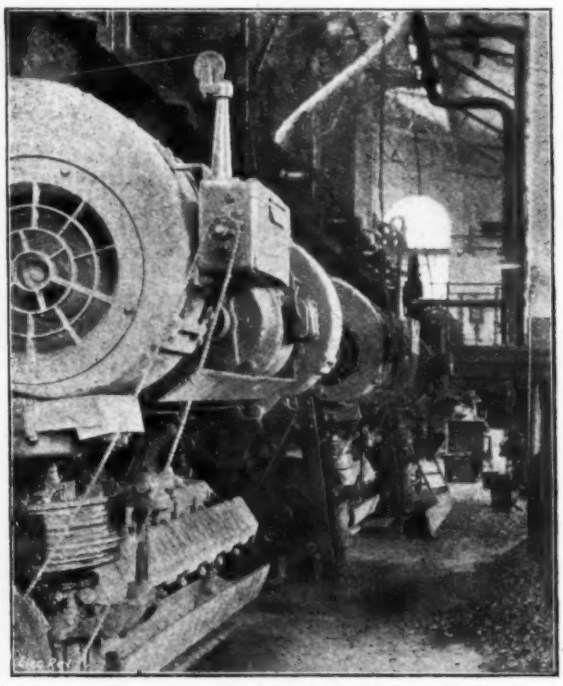


Fig. 2.—Underfeed Stokers and Draught Fans.

The new plant, which was inaugurated by the Mayor, Councillor S. Parsonage, J.P., on April 16th, includes two 3,000-r.p.m., 0.8 lagging power factor, 1,500-kW Brush-Ljungström turbo-alternators, fig. 1, the automatic governors being capable of adjustment at the turbines by hand and from the switchboard by electric control. The valveless rotary lubricating pump is assisted when starting by an auxiliary steam-driven pump, which can be automatically started in the event of the oil pressure falling below a predetermined value.

The condensers are of the two-flow Brush surface type, having a cooling surface of 2,500 sq. ft., and capable of dealing with 17,000 lb. of exhaust steam per hour, maintaining a vacuum of 28 in. (bar. 30 in.), with a constant supply of circulating water at a temperature of 73 deg. F. Air extraction is effected by means of Brush - Delas ejector plant, capable of extracting 11.85 lb. of dry air per hour, and maintaining the specified vacuum. The ejectors are of the two-stage type, the nozzles being in series. The water is extracted from the condensers by Pulsometer centrifugal pumps, capable of dealing with 30,000 lb. of water per hour and delivering against a total discharge head of 12 ft., driven at a speed of 1,440 r.p.m. by a 2½-b.h.p. Brush squirrel-cage motor.

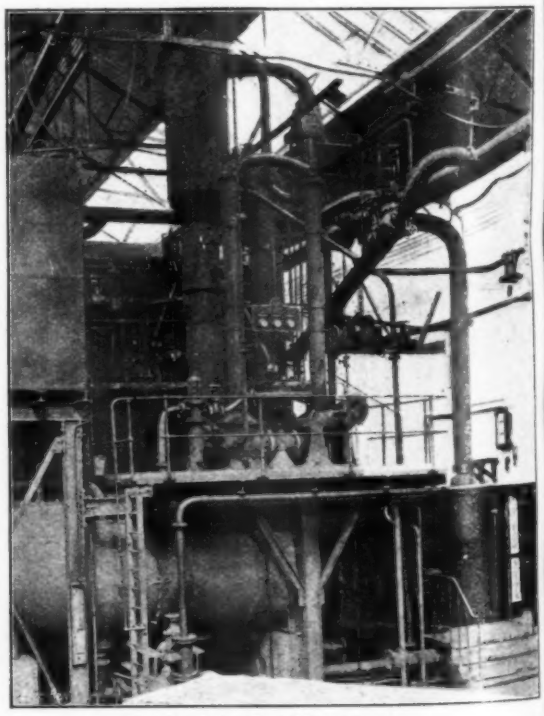


Fig. 3.—Boiler Feed Water Evaporator.

Mather & Platt centrifugal pumps provide the circulating water for the condensers. The pumps are of the

split-casing, low-lift type, and are capable of delivering continuously 2,100 gallons of water per minute against a total head of 31.5 ft. when running at a speed of 950 r.p.m. The pumps are driven by Brush 27½-h.p., 950-r.p.m. squirrel-cage motors. The motors are controlled by means of Ellison switchgear.

The cooling air for the alternators is drawn through "Visco" oil-film filters, capable of dealing with 4,500 cu. ft. of air per minute. A B.T.-H. steam meter is fitted to each set, and a temperature control panel has been supplied by Messrs. Negretti & Zambra.

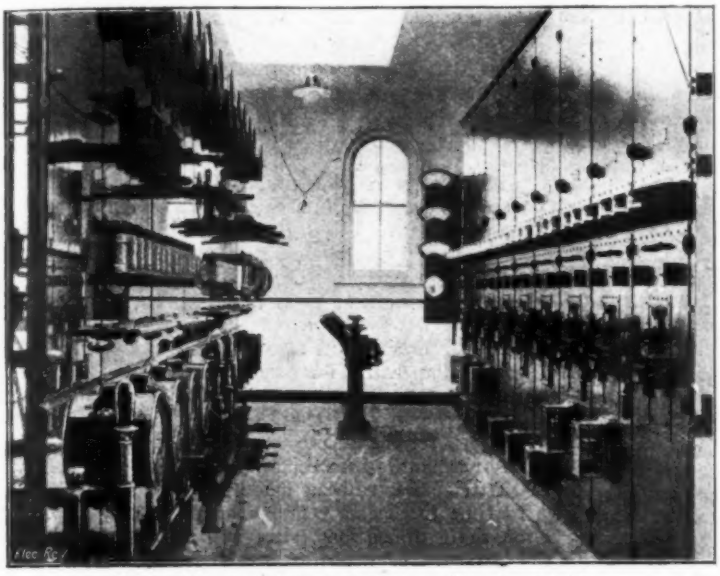


Fig. 4.—Main Control Board (right); Auxiliary Board (left).

Eventually three boilers will be on each side of the hot well, and the steam range will be divided so that one half of the plant can be shut down for economy in summer and for cleansing, &c. The present new installation consists of three Clayton Shuttleworth boilers supplied by Messrs. Babcock & Wilcox, Ltd.; they are the first of the straight-drum design erected in this country, and have a normal duty of 25,000 lb. of steam evaporation per hour and a maximum of 30,000 lb. per hour from and at 212 deg. F. The special feature is that they have separate down-take and up-take pipes for the lower three rows of fast steaming tubes, which are subject to radiant heat for the whole of their length; thus, it is claimed faster steaming is maintained and better continued evaporative capacity and efficiency, due to the fact that the passage of steam and water through the lower banks of tubes is so rapid that no scale can be deposited. Each boiler is fitted with a superheater of 1,120 sq. ft. for raising the temperature of the steam from 415 deg. to 665 deg. F., and fitted with "Tracey" steam purifiers to prevent water being carried over with the steam. The economisers, by Messrs. E. Green & Son, are of the cast-iron tri-tube type, of 1,754 sq. ft. heating surface, and raise the temperature of the feed water by about 140 deg., thereby saving a considerable amount of coal required at any particular duty of the boiler. The Underfeed stokers also discharge the ash to the conveyors below, are of 113 sq. ft. area, and are capable of burning up to 30 lb. of coal per sq. ft. of area per hour under normal conditions. They are supplied with forced draught from fans attached to the front of the stoker and driven by motors, which also operate the grate itself, as shown in fig. 2. Automatic feed regulators of the "Crosby" type and "Duplex Mono" flue-gas recorders have been fitted, also steam and coal meters and thermo-couple temperature recorders. As the water gauges are very high, there has been fitted an actuator in which an electrical solenoid operates a distant water level indicator on the boiler house floor level. From an outside bunker a Babcock & Wilcox elevator and conveyor drop the coal into the furnace hoppers; the ash drops by gravity into a water conveyor, by the Underfeed Stoker Co., and is conveyed along a tunnel outside the boiler house. Boiler feed water is obtainable either from the town's supply or from springs, and plant has been installed by P. & B. Evaporators, Ltd., fig. 3, for distilling the spring water. A closed-feed system is employed, and a Weir corrosion detector is connected in the main feed pipe range. Of the feed pumps, the one made by the Rees Roturbo Manufacturing Co., Ltd., is electrically driven, and one by Messrs. G. & J. Weir, Ltd., is steam-turbine driven. Fitted to the hot well is a Hydrokimeter, an automatic instrument which admits steam to the water should the temperature drop below 120 deg. to prevent condensation on the outsides of the economiser tubes. The present installation represents one-half of the eventual capacity of the boiler house, carrying one boiler as a stand-by.

New switch control, fig. 4, and transformer rooms have been built, and the old main single-phase switchboard has been altered to receive two separate single-phase supplies from the Scott-connected transformers, fig. 5, supplied by the British Electric Transformer Co., Ltd., which convert the 6,600-V, 3-phase energy, generated by the new machines to two-phase, 2,000 V, 50 cycles for distribution to the sub-stations. All the three-phase motors driving the station auxiliaries are fed at 415 volts from the new board shown on the left of fig. 4, which is supplied from the main board through two 200-kW transformers. The main control board shown to the right of fig. 4 consists of concrete cubicles with steel doors, the machine panels being provided with overload and balanced-current protective gear. This board, which was erected by the British Thomson-Houston Co., Ltd., is about to be extended by eight panels to accommodate an immediate extension of plant and cables for supplies in bulk to the Tonbridge Urban District Council and the Weald Electric Supply Co., which will increase the area supplied to approximately 360 sq. miles.

Sufficient of the plant described was completed in time to supply the town in July, 1924, and in connection with the conversion some difficult problems had to be solved. The town was divided into three sections, each of which was changed over in one day, and every motor, varying from 1/16 to 75 h.p., needed attention. The whole expense of the alteration was borne by the Council, but only amounted to £2 16s. per h.p. installed.

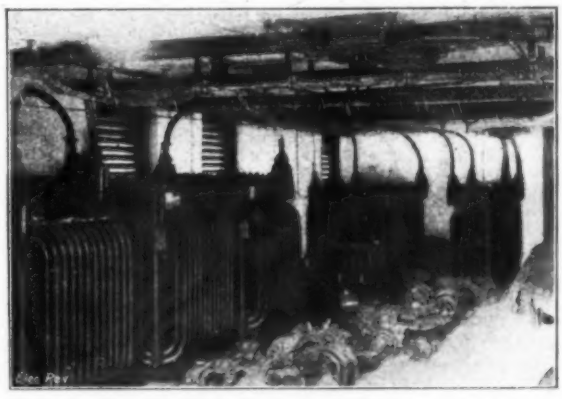


Fig. 5.—Scott-Connected Transformers.

In conclusion, we have to express our indebtedness to Mr. R. N. Torpy, M.I.E.E., A.M.I.Mech.E., borough electrical engineer, for assistance in the preparation of this article.

The Improved Production of Electric Motors.

By "M.I.E.E."

The position of the electrical industry in this country since the war has caused considerable misgiving to those who have appreciated what has been and is being accomplished in the United States, and further, what Germany accomplished before the war and will undoubtedly do again in the near future.

With German competition temporarily eliminated and with the American industry mainly concerned in meeting the boom in its home industry, it may have been expected that in the six years following the war the industry in Great Britain would have established itself on a fairly sound foundation.

The facts are that the expansion in productive capacity that took place all over this country during the later part of the war and the years immediately following has not been met by the requisite amount of work to fill the shops, and consequently home competition has increased to an extent which threatens the stability of the entire industry. The question arises whether the industry as a whole could not be so organised as to afford to the manufacturers some mitigation of this excessive competition without increasing the selling costs of the products.

In this article only a small section of the electrical business will be considered, but if the proposals put forward are sound for the motor business, they could be applied to many other lines of manufacture.

Prior to the war, electric motors for industrial purposes, both alternating and direct current types, from the smallest sizes up to, say, 50 h.p., were not produced in Great Britain so cheaply as in Germany or the United States; the smaller the motor the greater was the difference in price. Since the war, comparisons on a fair basis with German production have become extremely difficult. It is the fact, however, that German motors of small sizes are again being offered at prices often as low as half the British price, and there is little doubt that we may expect in the not distant future to be in competition with a motor industry in Germany even more efficient than it was before the war. With regard to the States, it holds good to-day as it did before the war, that they produce the smaller sizes of motor for a lower expenditure of labour than we do. And with the termination of their boom period, this lower labour expenditure will enable them to dump motors on our markets at prices below our present level.

It has not been, and is not, a question of design in the narrow sense. A comparison of designs indicates that in the average case the British motor shows as great an economy of copper and iron as either the German or American. The explanation lies principally in quantity production. The largest output in this country from any one factory prior to the war was approximately 10 per cent. only of that from the A.E.G. Since the war, the output from one only of the large companies in the States has been rather more than six times that of any British firm in regard to motors over the range of sizes under consideration. In this particular field of work we have in this country some seventy concerns competing. About forty of these are small firms, and are concerned mainly in special lines, but the remaining thirty compete over practically the whole range. Also opposed to quantity production is the handicap in the home market of the lower degree of standardisation in respect of voltages, frequencies, and speeds as compared with either the German or American home markets. Further, there are the widely varying requirements of public departments, consulting engineers and other authorities.

The object of this article is to suggest that a national standardisation of a.c. and d.c. industrial motors over the range of sizes mentioned, is the first step out of the present unsatisfactory conditions, and that standards once set up would enable the industry to bring about a redistribution of work to take advantage of the lower prices possible with quantity production.

A considerable amount of standardisation has been already accomplished, and most of us are acquainted with the work done by the International Electrotechnical Commission, the British Engineering Standards Association (B.E.S.A.), and other bodies.

Standards of performance, temperature limits for different grades of insulation, pressure tests, and definitions of different types of enclosures have been dealt with fully, and details such as sizes of carbon brushes and standard terminals have been covered by B.E.S.A. specifications. The grades and thicknesses of electrical sheet iron used for the stator and rotor laminations of motors have become practically common throughout the world. Insulating materials have been classified, and there is now very little difference amongst leading manufacturers in the manner of winding and insulating coils. Papers read before the Institution of Electrical Engineers and similar bodies, articles in the technical Press, the broadcasting of manufacturers' publicity matter—all these have tended to force the design of electric motors into certain defined channels.

Attempts have been made in this country from time to time to effect a common agreement in the industry on shaft dimensions, sizes of keys, types and sizes of bearings, commutator wearing depths, heights of centres, location of holding-down bolts and coupling dimensions. These attempts, so far, have failed. Each manufacturer has his own standards, and an agreement on certain of these details of mechanical design would ultimately involve each manufacturer in new developments of a very costly nature.

The fact, however, that such attempts have been made indicates that both the manufacturers and the big users appreciate the desirability of such standardisation. In America recently the same matters have had considerable attention, and the Standardisation Committee interested has expressed the opinion that with the co-operation of the manufacturers, outline dimensions could at least be standardised.

It is the author's opinion that, instead of working up to an ultimately definite standard design of motor on the piecemeal lines just mentioned, it would be better to go out for the complete standardisation at once. This might be accomplished along the following lines:—

From the bodies associated with the B.E.S.A. a committee would be set up of those interested, consisting of representatives from the manufacturers, large users, Government bodies and leading consultants. The committee would be similar in constitution to those that have functioned in the past on questions of standardisation, and its first business would be to appoint a small sub-committee of some three or four men to collect data and make recommendations. To those accustomed to committee work it will be obvious that this sub-committee should be small, and should consist of technical men with a sound knowledge of design, wide shop experience, and a knowledge of the market requirements. The sub-committee would consider designs submitted by various manufacturers, and from these would evolve designs to cover the range—50 h.p. and below—under consideration. This would be a matter of some twelve frames for each of the a.c. and d.c. lines. As the work proceeded, the proposals of the sub-committee would be referred at each stage to the manufacturers represented on the main committee for criticism, and in this way a line of motors could be evolved which would represent the best practice in this country in regard to performance, weight, simplicity of design, and consequent cheapness of manufacture.

The sub-committee's report to the main committee would furnish general sectional arrangement drawings, weights, and complete specifications of the motors decided upon, together with schedules of performance,

and a full statement would accompany these, giving the reasons governing the sub-committee in its various selections. The main committee would deliberate on these, and criticisms from the users' representatives would be considered and dealt with. A B.E.S.A. report would then be issued and the matter left to the manufacturers.

A committee of motor manufacturers would sit to determine the best distribution of this standard motor work with a view to getting all motors of one particular size built in one, or possibly two shops, so that as much advantage as possible could be obtained from quantity production consistent with the necessary safeguards against the formation of profiteering monopolies. It would be necessary to make arrangements by which each company could factor any of these standard motors, and the intersale between the various companies at the market rates, less a suitable discount, would have to be arranged.

The principal criticisms that may be offered against the scheme outlined above are:—

(1) That standardisation is opposed to progress.

(2) That the scheme is impossible of accomplishment.

(1) It is almost as hard for the average engineer to take a dispassionate judicial view of standardisation and mass production as it is for the man in the street to view free trade and protection without heat and in a spirit of sensible inquiry.

Many engineers dislike the word "standardisation," and automatically associate it with stagnation. A creative engineering mind naturally considers that to pause to standardise is to take up time that could be occupied in reaching out further; and that standards once set up are difficult to alter.

The standardisation of any engineering apparatus in its early stages of development is, of course, wrong. It stultifies progress and creates a morass of artificial difficulties. In regard to electric motors for ordinary industrial purposes this stage is long since past, and for a number of years now the design of both alternating and continuous-current motors has followed closely defined lines. The differences between motors of the same size of a dozen different makes in this country are not fundamental, but rather the expression of the individuality of the designer. There are differences in the diameters and lengths of rotors, in the numbers, sizes and shapes of slots, &c., and it is these petty differences that a national standardisation would eliminate.

This country has ranked high in the past for inventive genius, but not for the genius that takes the new thing and organises it properly. Standardisation is, after all, only a necessary part of efficient organisation.

The idea of co-operation inseparable from standardisation is antagonistic to British notions. The British attitude is the conservatism that damns a man who has had things his own way too long.

A national standard on the lines suggested would necessitate co-operation where competition now exists. It would mean the pooling of engineers' brains. Given a reasonable amount of goodwill, it should result in a position in common-sense design in advance of any yet reached, and should establish a jumping-off point from which further improvements could be made. Such a standard, while affording security to the user, would remove the excuse for voluminous specifications by Government departments, municipal authorities, and consulting engineers. It would remove the necessity of employing numbers of people in various companies up and down the country to interpret these specifications, to produce tenders to meet them, to change drawings to bring various features into line, to estimate the cost of these changes, and so on. In short, it would remove a very large amount of quite unnecessary work and make it possible for more time and care to be spent on those lines of work which really demand special treatment.

(2) Many, probably most, of those interested in the motor business will be of the opinion that the work of the committee suggested could not be carried out or, in the remote event of a satisfactory completion of the standardisation, that the manufacturers would never reach an understanding in regard to the division of the work.

Since the scheme is obviously intrinsically possible, this criticism amounts to an assertion that the goodwill of the manufacturers could not be obtained; that the manufacturers could not be convinced that their interests were best served by the scheme. Let us, therefore, consider the position of the manufacturer at the present time and see whether the conditions under which he has to manufacture are not so difficult and costly that he will welcome any scheme leading to simplification.

In spite of the fact that the design of both alternating and direct-current motors has been a comparatively settled thing for the past decade, the manufacturers have had continually increasing difficulties to meet, in that the more extended application of electric motors has caused special features to be continually added to the standards which each manufacturer has adopted.

Every motor manufacturer striving for low costs looks around for business that will give him quantities of motors exactly alike, which can be brought through the shops semi-automatically with the facility of manufacture that follows on an expensive equipment of tools and gauges. That is what he would like to have, but what he actually has is as follows:—

If he deals in both alternating- and direct-current motors for a range of 200 horse-power or thereabouts and below, he will have forty or fifty different frames. Each of these may have to be made of any of the following types:—Protected, enclosed ventilated, pipe ventilated, totally enclosed, drip proof or explosion proof, and may have to be made for horizontal or vertical operation. Light-type motors will be required for the majority of applications, and a special heavy type for certain steel mill drives. He must be prepared to supply motors for belt drive, for direct coupling, or for gear drives, and customers may demand ball bearings where sleeve-type journal bearings happen to be his standard, or *vice versa*. He must be prepared to meet customers' or consulting engineers' fads with regard to insulation, terminal gear, and numerous other points. With such a range of sizes and with increasing demands for variations to meet particular service conditions, it is clearly in the manufacturer's interest to standardise whatever is possible of standardisation. Let us consider the position particularly in regard to one size only, say a 10 horse-power direct-current motor. In this country there are some thirty makers of this particular size of motor, and the business done amounts to some two thousand motors per annum. One or two makers secure about two hundred yearly, but the bulk of the manufacturers have to be content with a much smaller number. If all these motors were built in one factory under an efficient organisation, the reduction in costs would be of the order of 20 to 30 per cent., and a better product would be assured.

If, therefore, instead of each manufacturer building a few of all these different sizes and kinds, he dealt with a large number of a few sizes, a gain all round is apparent. The total amount of business done by each manufacturer need not be diminished, but increased since, with the gain in lower production costs, a larger amount of export business should be obtained.

It has been the object of the author to keep this article as short as possible and to put forward a proposition free from all elaborations. In the original draft the work of the standardisation committee was developed in detail; figures for the savings possible in manufacturing large numbers of similar motors were gone into, and possible ways of dividing the work were considered. It was decided finally that the fundamentals of the propositions put forward would be accorded a reception of so doubtful a nature that it were wiser to deal only with these.

Those who are running small businesses may feel that a scheme of this sort would wipe them out of existence. On the contrary, it is the fact that a number of these smaller concerns are better adapted to produce the very

small motors than the large companies. Where this is not the case, it is better for the industry as a whole for them to disappear.

The big companies may argue that, with the design of the standard motor common property, the competition will be worse than ever, due to innumerable small firms taking up its manufacture. If a big company dealing with a particular division of this work and equipped for quantity production cannot produce its motors at a price impossible to a new competitor, then it is due to inefficiency, and such a firm is better out of the business.

It may be suggested that if division of work can be effected amongst manufacturers on the basis proposed, it might very well be done on a much wider scale, one firm making large generators, another motors, a third transformers, and so on. It is simply a question of degree. The proposition put forward is a small step relatively, and involves the various firms in comparatively little disturbance of shop tools and equipment. Following the success of the smaller scheme, undoubtedly more ambitious projects would follow.

If the financial interests behind the big manufacturing concerns can be convinced that a scheme on the lines suggested will pay, then, no doubt, it will be made possible. It is doubtful whether these interests have sufficient appreciation of the rapidly-increasing complexity of the electrical manufacturing industry. If this can be brought home to them adequately, then efforts can be expected towards a broader-viewed organisation of the industry.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Future of Broadcasting.—On April 6th, Mr. Baldwin informed Lieut.-Commander Kenworthy that the whole question of broadcasting would have to be examined in anticipation of the expiry of the existing agreement with the British Broadcasting Co. on December 31st, 1926. He thought that the matter would have to be considered during the coming winter, and the question of broadcasting the proceedings of Parliament was one of the things which would have to be considered.

Imperial Radio Communication.—On April 6th, Mr. Hurd asked the Prime Minister if he was aware of the growing diversity of policy and practice as between this country and the Dominions in the matter of Empire radio facilities; and whether, with a view to unity in this matter, he would adopt the suggestion of the Empire Press Union and invite the Governments of the Dominions to confer with our own Government, so as to bring an end to the present confusion and give the Empire a system at least as effective as those of foreign countries.

Mr. Baldwin said his information did not bear out the suggestions made. The arrangements in connection with the institution of the Imperial radio service were proceeding satisfactorily, and there was general accord between His Majesty's Government and the self-governing Dominions with regard to the subject.

On April 7th, Mr. T. Thomson asked what stage had been reached in the promotion of the scheme to provide an Imperial radio service.

Sir Wm. Mitchell-Thomson said that the high-power station which was in course of erection at Rugby was expected to be completed by November next. Sites for the beam stations for communication with Canada and South Africa had been placed at the disposal of the Marconi Co., and the stations were due to be completed early in October. Sites for the beam stations for communication with India and Australia had been submitted to the company for approval, and those stations should be completed within nine months of the actual provision of the sites. The corresponding beam stations in the Dominions were in various stages of progress. The latest reports indicated that the South African and Canadian stations would be completed about the same time as the corresponding stations here. The stations in India and Australia would probably not be ready before the end of this year or the early part of next year. The Dominions had been invited to nominate representatives to a permanent Committee under the Chairmanship of the Assistant Postmaster-General to consider practical details of working the services.

Electricity (Supply) Acts (1882 to 1922) Amendment Bill.—On April 7th Mr. Harris asked leave to bring in a Bill to increase the powers of Joint Electricity Authorities. He said there was general agreement as to the need for legislation dealing with electricity. Although it was about five years since the Act setting up the Electricity Commissioners was passed, very little progress had been made. One or two authorities had been set up, but they had not been able to function, and there was a general consensus of opinion that their failure had been due to the absence of compulsory powers. The object of his Bill was to restore those compulsory powers which were deleted from the Act of 1919.

Mr. Hopkinson, who opposed the Bill, said that at present the one thing they must be careful about in dealing with electric power generation and distribution was the danger of stereotyping technical practice. He was opposed to the Bill, and he believed the Government was opposed to it also, simply on that ground. The whole question of electric power generation and distribution was in the melting pot at present, and it was highly probable that in a few years we should see very great technical advances and new methods of generation. Speaking of possible developments in the future, he said that there was not the least doubt that towards the end of the present generation we should see the direct generation of electricity by the oxidation of coal in some form of carbon cell. The Bill would be disastrous to technical progress.

Leave to introduce the Bill was refused by 193 votes to 124.

Post Office Wireless Committee.—On April 7th, in reply to Sir H. Brittain, who asked what was the number of individuals serving on the Post Office Wireless Committee, Sir Wm. Mitchell-Thomson said that the Committee, which was appointed by the late Cabinet, consisted of nine members, of whom three were civil servants. It did not present a report, but after consideration of the evidence submitted to it, he had made certain changes in organisation. It was not proposed to appoint a further committee on the subject.

South Devon Electricity Order. — On April 7th, Major Harvey asked the Minister of Transport if he was aware that the delay in dealing with the application for the Central South Devon Electricity Order and the refusal to grant powers which would lead to the immediate supply of electricity to a large area, with regard to which there was no competing application, was causing inconvenience in the locality; and if he would expedite proceedings in this matter.

Colonel Ashley said that the scheme submitted with this application did not appear to the Electricity Commissioners to be satisfactory or sufficiently comprehensive from a technical point of view, and the promoter was asked to submit a further scheme. This had not yet been received. There was a competing application in respect of a part of the area concerned, and so soon as the further scheme asked for had been received, the Commissioner intended to hold a local inquiry into the two applications.

Railway Breakdown. — On April 7th, Sir Alfred Butt asked the Minister of Transport whether his attention had been drawn to the serious breakdown on the electric railway between Balham and Victoria on April 1st; whether he proposed to hold inquiries into such accidents; whether he had taken steps to obtain an authoritative estimate from experts of the comparative merits of the live-wire and live-rail systems of electrification; and why the live-wire system had lately been extended in disregard of the fact that the live-rail was the standard system of electrification for railways in the London area.

Colonel Ashley said that with regard to the first part of the question, failures of motive power, or temporary dislocations of service, which did not cause, and were not likely to cause, personal injury were not within his powers of inquiry. As regarded the second part, his hon. friend would see from the interim report of the Electrification of Railways Advisory Committee, which fully investigated the systems of electrification for this country in 1920, that the extension of the overhead conductor system on the Brighton Section of the Southern Railway was in accordance with the views of that Committee.

London Electricity Supply Bills.—The further consideration of the London Electricity Supply (Nos. 1 and 2) Bills and of the North Metropolitan Electric Power Supply Company Bill has been deferred until April 28th.

The "Budget."—Mr. Baldwin informed Mr. MacDonald on April 8th that the Chancellor of the Exchequer would introduce his "Budget" on April 28th, the day upon which Parliament re-assembles.

Faulty Installation Materials.—An echo of the war and the period during which the cost of plant and materials was very high is contained in a petition which has just been presented to the Swedish Board of Trade by the Swedish Fire Tariff Association and several other fire insurance companies in that country. The petitioners ask the Board to adopt measures for bringing about an obligatory revision of the domestic installations carried out in Sweden with the materials used in those critical times. Despite the comprehensive work of inspection, the petitioners submit that the statistics kept by the fire-insurance companies show that in Sweden electrical installations are the cause of a considerable part of the damage brought about by fires, and they therefore suggest that it is of great importance that an improvement should be made in the conditions.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Aeroplane Crashes and Ignition Circuits.

Whole-hearted approval of Mr. Booth's object in raising this question will be present in the minds of all of us. At the same time, if the suggestion is unfounded, it will be agreed that in the interests of aero matters generally, it should be controverted. The undersigned submits that the weight of technical argument and evidence is so much against it as to render it highly desirable that attention be not diverted unduly from other possible causes of aeroplane crashes.

The maximum p.d. which the condenser or primary winding of an ignition generator is called upon to withstand (momentarily) is of the order of a few hundreds of volts, and these two components must in every case be insulated accordingly. All condensers for ignition systems are, or should be, tested on an alternating r.m.s. voltage of this order at commercial frequency for a period of several minutes without breakdown. This is equivalent to a maximum voltage about 40 per cent. greater. The necessary factor of safety is mostly contained in the relatively much longer period of application on test, as compared with the working condition. In the undersigned's experience of ignition generators manufactured by reputable firms, condenser failure is practically unknown. In his opinion condensers and magnetos which "fail so repeatedly" cannot be "well made."

This maximum p.d. of a few hundreds of volts is such that it is capable of producing a spark across only the very smallest gap that can ordinarily be handled. It can readily be demonstrated on any ordinary ignition generator, however connected, that the voltage across the condenser is never sufficient to break across a gap of appreciable magnitude, say, .005 in. But here a word of caution is necessary, *i.e.*, the test gap must be connected to the condenser terminals by the shortest possible wires. Utilising wires of any length it is readily possible, owing to electrical resonance in these lengths, to get a p.d. at the free ends capable of sparking over a considerable gap. In passing, it is, for the same reason, incorrect to connect the primary condenser of an ignition system other than as nearly directly across the contact points as possible.

Mr. Booth did not tell us the size of his spark gap, but if it was greater than .005 in., either the resonance explanation is applicable, or there existed some other abnormal condition on the system on which the experiment was made.

The undersigned has, using a spark gap, made the experiment on both battery ignition and magneto, and demonstrated to his own satisfaction, both with short wires and with long wires, connecting the spark gap to the condenser, that there is no material difference between the gaps which can be sparked over in the two cases of "correct" and "incorrect" methods.

As regards insulation, the primary and secondary windings in series, as in figs. 2, 3 and 4, virtually constitute one winding, of which the alternating potential at any point increases progressively from zero at the end of the primary winding in connection with the battery to several thousand volts at the h.p. terminal. It is only necessary for the insulation to earth to increase progressively with the number of turns, and therefore with the voltage, the insulation of the primary being suitable for about 600 volts. If the insulation is such that the secondary voltage can spark across the layers, there is little hope for the coil in any case. There appears to be no reason based on sound principles why the primary winding should require any more insulation when connected "auto" than when connected non-auto.

Now with reference to Mr. Booth's numbered answers:—

(1) It is agreed that majorities are not always right. But surely in this case it is difficult to imagine that so many capable magneto engineers have gone wrong on this point.

(2) Dual ignition is fitted very largely to mitigate fault development in sparking plugs, which, as everyone will admit, constitute a weak link in the high-compression aero engine chain. I am informed that aero engines are invariably run with both ignitions functioning. This minimises fouling, avoids detonation, explodes the charge more rapidly and uniformly, and gives more power.

(3) This is already sufficiently answered.

(4) The whole of the active energy developed by the ignition generator per break is momentarily stored in the condenser in any case.

The undersigned is not clear as to Mr. Booth's object in asking for an opinion of the impedance of (*a*) and (*b*). In (*a*), if by a "plain" condenser Mr. Booth means a primary ignition condenser of the ordinary type, if this were subject to an a.c. voltage of 3,000 V at 200 periods, naturally, the condenser would break down. Even if it were made just to stand this voltage initially, the dielectric hysteresis losses at this voltage and frequency would be so large that the condenser would be destroyed by heating in a few moments. (*b*) Might have an average inductance for the working condition of .010 henry, and therefore a reactance of 4π ohms at 200 periods. It is evident that this also would be burnt up.

What Mr. Booth appears to fail to realise is that the condenser never can receive this high voltage, but at the most about 600 volts. A simple calculation, for which I can give typical basic quantities if desired, would show that the supply of energy would be totally inadequate to charge a condenser of this capacity up to 3,000 volts. The condenser may be put right across the h.p. terminals of the coil without breakdown. No doubt Mr. Booth himself has had a shock from a coil capable of developing on open circuit 3,000 or even 10,000 secondary volts, but would he care to have a shock from a power line at that voltage?

It is, of course, a question of regulation; one never receives shocks of more than a few hundred volts from a h.p. coil. Neither will the primary condenser, even if placed in parallel with a variable h.p. gap, allow the voltage to rise sufficiently to spark over more than the merest fraction of an inch.

If not too far trespassing upon your valuable space, there is one other point in the original article which suggests itself. I have the impression that black smoke cannot be emitted from the exhaust of any engine as a result of the ignition ceasing to function, and that black smoke implies, not fired charges, but exploded over-rich mixture. In this, however, I am open to correction.

E. Fowler Clark, A.M.I.E.E.

Derby, *April 7th*, 1925.

Surely the "green deposit" referred to by Mr. K. Cardiff is the corrosion due to the use of flux in soldering breaks in the winding or at the primary secondary joint in the armature itself!

Notice how frequently the connection between the "lead-out" wire from the h.p. end is eaten through, sometimes to a depth of several layers! The spark continues to pass across this, forming a track for itself until the resistance becomes too great, and then "missing" begins. Is this not the root of a great deal of direct and indirect trouble, causing burning away of the platinum points?

The condenser is often wrongly blamed for this failure. The connections should be made with resin as a flux, cleaned and varnished over afterwards. How does Mr. A. C. Booth account for NU-4-type magnetos breaking down? These have electrically independent primary and secondary windings; the latter are open-ended, the spark having to jump across two plugs in series.

There is great difficulty in efficiently insulating the secondary from the primary and from the core, owing to the fact that the full high pressure traverses the circuit and tends to jump to earth or to the primary. Admittedly the armature is subjected to a severe strain in inducing the spark to jump two plugs in series, but it will be noted that only one plug is "under compression" at the time the spark occurs.

Where the standard connections are used, the voltage gradually builds up from the primary, increasing with each turn of the secondary; hence the h.p. winding requires to be "tapered" away from the sides of the core towards the finish, and the insulation strengthened. How often does the comparatively slight insulation of the primary break down? Is it not joined to the core at the start? If the current cannot readily return through the primary circuit, why is a shock not experienced upon bridging the earth and centre screw (the junction of primary and secondary windings) with the fingers?

Further, are modern mica condensers for magnetos (*e.g.*, B.T.-H.) not submitted to a test of 600 volts, 50 cycles, between plates? Are they really the cause of the majority of breakdowns?

Does Mr. Booth not mean 200,000 ohms in his sketch?

Vammos.

April 9th, 1925.

Maxtorq Motors.

I have to admire the very able manner in which Mr. Wood, on behalf of the Lancashire Dynamo & Motor Co., replies to my letter of April 3rd, the more so as he most ingeniously contrives to avoid telling us the real facts about this "Maxtorq" motor.

Dealing with the subject of high-resistance rotors, the last paragraph of Mr. Wood's letter implies that the "Maxtorq" crane motor is not an ordinary high-resistance-rotor machine, and yet is better than such a high-resistance-rotor machine from the point of view of "smooth acceleration and close inching." This is a very sweeping statement to make technically, and I would point out that the instability of an ordinary induction motor at low speeds is due to the self-inductive reactance of the windings. Increasing the rotor resistance alters the shape of the "speed-torque" curve and tends to stabilise the behaviour of the motor at low speeds. Now, if Mr. Wood is to obtain something better than the high-resistance rotor he must employ windings or a device having capacity reactance. Has the Lancashire Dynamo & Motor Co.'s "Maxtorq" motor for crane service got static condensers on the rotor? If not, there is nothing in its performance novel or better than what was on the market 20 years ago.

A claim is made in the article dealing with Cannon Bros.' Stanley Mills, on p. 460 of the ELECTRICAL REVIEW, that the starting current is so far reduced by various design features that "Maxtorq" motors can be started by switching them direct on the line. You, Sirs, were apparently under the impression that there was some special feature in the slot design, but we are now told that it is the result of "divided end

rings, especially designed windings, and in some cases magnetic eddy-current disks." This may be so, but why not reply to my query and say just how much the effective resistance at standstill is increased by these features? Alternatively, what is the starting current in terms of full-load current of a "Maxtorq" motor specially designed for direct starting and intended for continuous operation in a textile mill?

D. B. Hosenson.

Bowdon, *April 11th*, 1925.

Billiard-Table Ironing.

We note with interest the remarks about billiard table irons in your current issue. If the iron warps with the heat it is either because the soleplate of the iron is too thin, or else the iron is overloaded.

The billiard-table iron that we manufacture has a soleplate ¼ in. thick which is machined on both surfaces, so that it is quite as flat as a billiard table, and the load, 600 watts, provides quite sufficient heat for the purpose, and is low enough to make warping impossible.

The Electric Heating Co.

Croydon, *April 6th*, 1925.

May I through your valuable journal reply to the letter which I saw in your "Correspondence" columns, stating that "folk who use billiard irons have occasion to complain of marks left on the table"?

The writer of that letter, who signs himself "Billiards," tells us that this is caused by the iron warping with the heat. In all my experience of electric heating, I have not yet come across a billiard iron with a warped soleplate; I have certainly seen a few inferior makes, with which no firm of repute would associate its name, with undulated surfaces, probably brought about by being emeried on the periphery of a bob instead of being done on a decent-sized lap.

Your correspondent can be shown a billiard iron which has been in use for 7½ years continuously, without any complaints.

It is also reasonable to ask, if a billiard iron soleplate can warp, with a thickness of approximately 1½ in., how is it that a machine propelled "Jumbo" iron with a soleplate of approximately ¾ in. and three times the loading, stands up to its work for approximately eight hours per day?

D. White,
Engineer, Hotpoint Electrical Appliance Co., Ltd.

London, *April 7th*, 1925.

A Joint Contractors' Exhibit.

Referring to your announcement of the Grimsby Electrical Exhibition on page 534 in the current issue of the ELECTRICAL REVIEW, the fact that the principal electrical contractors in Grimsby co-operated and made an extensive display has been totally ignored. In view of the numerous allegations in the Press of the apathy of contractors, I should like to draw your attention to the fact that a third of the space was occupied by the joint contractors' exhibit.

I enclose photographs of the contractors' stand and subscribe myself

Contractor.

Grimsby, *April 8th*, 1925.

[We congratulate the Grimsby contractors on their display of activity, and wish them the success that they deserve.—EDS. ELEC. REV.]

High Wages in Sheltered Occupations.

Attention is being drawn to the shipbuilding orders recently placed abroad, and much of the blame is being allocated to the tradesmen and their unions. No doubt much can be laid to this account, especially in the shipbuilding and repairing yards, due to the proverbial slacking, and the unnecessarily fine demarcation of trades, and again to the shortsighted refusal to operate labour-saving devices to the full.

It should be kept before the general public, and particularly workers in the non-sheltered trades, that the non-sheltered trades, such as engineering, mining, textile, ocean transport, &c., are the real source of our wealth.

Sheltered occupations in civil or municipal service, building, teaching, &c., should only receive remuneration in accordance with that of the trades producing the means for international barter. In a self-contained, self-supporting community operating behind a tariff wall, this is not of such vital importance.

Looking upon the nation as a family, the wage-earner drawing £5 a week cannot maintain hired help at £6 a week.

Teachers are to lose, roughly, 5 per cent. over, say, 10 years. Who pays them? Compare their case with that of the miners, or better, with the engineers', reductions of 3s., 3s., 12½ per cent., and, I believe, 17s. 6d. All the overpaid State and municipal services are maintained principally by our overburdened industries.

The unfair conditions imposed on our workers due to the non-payment of allied debts are possibly beyond our immediate control, and have been dealt with elsewhere.

Heavy rates and taxes—direct and indirect—will not permit of further reductions in the wages of miners, engineers, &c. Every auxiliary service required by the non-sheltered manufacturer—*e.g.*, building, transport—has to be paid for at twice its true value.

A further factor militating against a fall in wages is the excessive profits taken by shopkeepers.

It is almost too much to expect to find a sufficiently united and determined government to apply the remedy. The only hope would appear to lie in a concerted action by the (more fully informed) workers in the non-sheltered trades against the excessively high wages of the other occupations and of their own public services.

Immediate action is required, as every lost order means fewer employed and increased rates and taxes.

E. W. Ashby, B.Sc., A.M.I.E.E.

Wallasey, *April 6th*, 1925.

Sea-going Electricians.

With reference to the above and "Cymro's" letter, I will endeavour to give the information required.

(1) Experience.—It is necessary to be able to run and maintain the whole installation.

(2) Daily Routine. (*a*) at Sea.—It is difficult to give any set routine, as one day the "Batti-Wallah" will be rushed with work, and another quite slack; again, it is quite possible that very little turns up during the day, but in the middle of the night one may be turned out for navigation lights, stokehold lights, forced-draught fan motors, &c. There are seven days to the week, however. The sea-going electrician has no set hours, but carries on as required, and must take the good with the bad.

(*b*) In Port.—At intermediate ports, very similar to being at sea, except that he will have cargo and mail lights in addition. In terminal ports one is engaged in the overhaul of all plant which is normally running the whole time at sea, such as dynamos, motors, &c.

(3) Plant.—High-speed reciprocating sets are usually met with, such as Belliss & Morcom, Clarke-Chapman, Tangye, &c.

The electrician, or senior electrician (in the case of larger vessels), is responsible to the chief engineer for the electrical gear of the ship.

The above particulars are applicable to the P. & O.; the other lines I cannot speak for.

Once a Batti-Wallah.

April 6th, 1925.

Street Explosions.

Your correspondent in last week's issue, with reference to the above, is probably correct when he states that the cause of the explosions in the electric cable manholes referred to should be sought from a different source than that of the adjacent gas mains. Accumulations of coal gas will cause explosions if ignited, but, generally speaking, this is not the cause in the case of electric street boxes and manholes.

Without any knowledge of the circumstances or details of the cases referred to, may I suggest that a very common cause of explosions is that due to cable faults.

Your correspondent does not state whether there was any mains trouble on at the time, so that without these details it is very difficult to suggest a cause.

Some years ago the Board of Trade held an inquiry into the causes of a number of explosions that had taken place in electric manholes and street boxes. The report pointed out that many explosions were due to highly-explosive gases that could be generated at a fault on the cables. Under certain conditions it was found possible by the nature of some kind of faults for gases to be generated that developed such an extremely high temperature as to be self-igniting, when no indication might be observed at the source of supply until a serious "short-circuit" fault had developed or an explosion taken place. These gases enter adjacent pipes containing other cables, and sewers, so that when an explosion does take place, its effect may be very widespread, manhole covers and street-box lids being blown up some distance perhaps from the seat of the actual fault.

This explanation may have no bearing on the case your correspondent quotes, but it is certainly the cause of many explosions.

P. B. Addison, A.M.I.E.E.

Newcastle-upon-Tyne, *April 6th*, 1925.

The Electric Iron.

My attention has been directed to a reply to my letter in your issue of April 3rd by the Electric Heating Co., of Croydon. This letter offers no useful criticism of the points raised, and further, makes an absurd and irrelevant statement implying the writer's connection with the marketing of a competitive iron, and therefore calls for no further comment.

Observer.

London, *April 9th*, 1925.

With reference to "Observer's" remarks, I think it would be best if he would oblige by letting us know whether his remarks apply to the foreign make of electric iron.

If so, I can fully endorse his statements, but the English make of iron is efficient in every way, and only wants to be handled by a person with a share of common sense, and the hope of causing fires with electric irons would be dashed to the ground.

With reference to his three points, it is obvious that "Observer" is not a user of the electric iron, as he or she would soon appreciate its value.

I would like to add that it is this sort of remarks that holds prospective buyers back, and thus helps to swell our unemployed; what we want is encouragement, and then we can all pull together and buy English-made goods.

Best English Value Only.

April 7th, 1925.

Lead-covered Wiring and Visible Bonding.

We have read with interest the correspondence under the above heading. Like everything else, there are good and bad boxes, just as there are adherents to this or that system.

If real visibility of bonding can be had, and if it does not cost extra, then in our opinion it should be used.

We see a good deal of all systems, and one which seems to stand out is the "Sanco" joint box. The bonding is simple and effective, the box is robust and universal, taking any size of cable, and it can be made in any number of ways.

Lead-covered wiring is cheap, but if good fittings are used, a sound and effective installation is obtained. The wiring should have fittings which are good and also keep down the labour cost of fixing; this is where the "Sanco" joint box scores.

W. E. Beardsall & Co., Ltd.
W. DRAPER.

Manchester, *April 7th*, 1925.

[If there is any make of joint box which has not been acclaimed the best in this correspondence, let it be named at once or not at all, as we are about to close this discussion.—EDS. ELEC. REV.]

Cage Aerials.

Referring to the sketch in your issue of April 3rd, I made one almost similar, but with thin copper tape round the 8-ft. hoops, which were joined by vertical strips. On a crystal set the result was no better than with my "frame," an inside wire on a wall; the cage was blown away, leaving the connecting wire, which descends at several angles to the set. There was no difference in the results, so I am not replacing the cage.

Killingworth Hedges.

London, *April 7th*, 1925.

Business Notes.

Bankruptcy Proceedings.—B. E. DIXON, trading as the Creswick Dixon Electric Co. at Sheffield and Chesterfield, electrical engineer. The following are creditors:—

	£		£
The Allied Electric Co.	63	Machin, W.	101
Bolter & Walden	27	McGrath, J. & J.	113
Best & Lloyd, Ltd.	20	Needham Bros., Ltd.	58
Bodworth Bros.	20	Newboult & Sons	26
Derbyshire Times	64	Spence	100
E. Sandem & Co., Ltd.	75	Whites, Ltd	34
Electric Fires, Ltd.	60	Walsh, John, Ltd.	76
Edison Swan Electric Co., Ltd.	44	Wood	65
Josephs, H., & Co., Ltd. ...	47	Bankers	220
Myers, C. A.	133	Neill, R., & Co.	214
Maguire, W.	130	Creswick, G.	400
Millett, P.	100	Arnold, F.	101

CYRIL BINNS, trading as the United Electrical Co., 55, Low Briggate, Shipley, Yorkshire, electrical engineer.—The public examination of this debtor was held recently at the County Court, Bradford. The statement of affairs showed liabilities of £375, and there was a deficiency of £344. Debtor commenced business in partnership with another, each of them contributing £50 capital. The arrangement terminated in November, 1923, when the business showed a deficiency of £93. Another partner subsequently came into the concern, and when he left debtor agreed to take over the liabilities of £234. Debtor attributed his failure to lack of capital and the small margin of profit on contract work. The examination was adjourned.

J. H. PAINTER (trading as Venables & Co.), 99, The Broadway, Cricklewood, N.W., electrician.—The first meeting of creditors was held on April 9th, at London Bankruptcy Buildings. The debtor, who filed his petition on March 26th, has lodged accounts showing total liabilities of £3,185 (unsecured £1,473), and net assets of £533. It appeared from statements that the debtor had made that he had been engaged as an electrician for the past 20 years, and for part of the time had carried on business in partnership. That partnership was dissolved just before war broke out, and he had since traded alone under the style of Venables & Co. At the end of 1919 he added to the business that of fancy goods dealer. Certain of his creditors had obtained judgments, and he had no alternative to filing his petition. The debtor attributed his failure to slack trade, bad debts, loss on contracts, and living beyond his means.

The meeting appointed Mr. W. A. J. Osborne (Corfield and Cripwell), C.A., Balfour House, Finsbury Pavement, E.C., as trustee of the debtor's estate.

The following are the principal creditors:—

	£		£
British Thomson-Houston Co., Ltd.	45	Siemens & English Electric Lamp Co., Ltd.	46
Baxter & Caunter, Ltd.	22	Sandle Bros.	41
D'Este, S. G.	135	Star Electric Lamp Co.	30
Electrical Supplies	23	Standard Fireworks Co.	31
General Electric Co., Ltd. ...	20	Times Electrical Co.	29
Oulhams, J. & G.	23	White, Ridsdale & Co.	65
Payne & Son, W.	180	Sloan Electrical Co.	734
Prince, J.	80		

HYMAN WEINER, trading as Harry G. Weiner & Co., 112, Wellington Street, Leicester, wholesale merchant.—The adjourned public examination of this debtor was held recently at the Castle, Leicester. The gross liabilities were returned at £12,939, of which £11,458 was expected to rank, against assets of £12,966, or an estimated surplus of £1,508. The Official Receiver said that at the last hearing debtor had been ordered to deliver up all his duplicate order books, all paid cheques, and note books, but this had not been done. The Official Receiver said that since the last meeting he had received from 22 people debtor's circular about the financial position of a certain company which had gone into liquidation. He suggested that through debtor's action creditors had lost £9,917, mostly for wireless goods. Debtor alleged that the letters he had sent were honest. He admitted that he had been a director of another company, but resigned. It had been stated that the books from November 21st, 1923, to January 24th, 1925, showed receipts of £6,457. On behalf of the trustee, it was stated that out of that money only £1,052 was paid into the bank. Debtor said he had dealt with £5,400 by way of cash. The examination was eventually adjourned *sine die*.

A. H. MONCRIEFF, Y.M.C.A. Commercial Hotel, Forster Square, Bradford, late 60, Thornton Road, Bradford, radio manufacturer.—The first meeting of creditors was held on April 8th, at the Official Receiver's Office, 12, Duke Street, Bradford. The statement of affairs showed gross liabilities of £375, of which £324 was expected to rank, and there was a deficiency of £312. Debtor attributed his failure to lack of capital. The matter was left in the hands of the Official Receiver as trustee of the estate.

EMLYN OWEN, trading as Emlyn Owen & Co., 1, Senghenydd Road, Cardiff, Glam., radio dealer.—The first meeting of creditors was held on April 9th at Cardiff. The statement of affairs showed gross liabilities of £1,888, of which £1,291 was expected to rank, against assets of £388, or a deficiency of £903. Debtor attributed his failure to lack of capital, excessive competition, employés starting in competition with him, and losses on contracts. The matter was left with the Official Receiver as trustee of the estate.

H. P. GALT, electrical engineer, 56, Norbury Road, Thornton Heath. Discharge suspended for two years, until March 9th, 1927.

J. V. WALLIS, wireless goods dealer, 46, King Street and 28, Regent Street, Cambridge.—Receiving order made April 6th, on debtor's own petition.

J. N. DAVENPORT and L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, Manchester. Receiving order made April 6th, on creditors' petition.

J. WORSLEY, electrician, 10, Green Street, Darwen.—First meeting, April 28th, at the Official Receiver's Offices, 11, Winckley Square, Preston. Public examination, May 6th, at the County Court, Blackburn.

S. SIDWELL, electrical engineer, 51, Islington Row, Birmingham.—Trustee, Mr. T. Easton, Official Receiver, 191, Corporation Street, Birmingham, released April 1st.

J. BURKETT, electrical engineer, 185, John Clay Street and 78, Anderson Street, South Shields.—Last day for proofs for dividend, April 30th. Trustee, Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

H. ROGERS, electrical engineer and contractor, Friars Gate and Barbould Street, Warrington.—Last day for proofs for dividend, April 25th. Trustee, Mr. B. Silcock, 31, Bold Street, Warrington.

Company Liquidations.—WIRELESS SERVICE, LTD., New Bond Street, W.—A meeting of creditors was held on April 7th at the offices of Messrs. Clinch & Legge, 119, Moorgate, E.C. The chair was occupied by Mr. W. R. Theobald, the liquidator in the voluntary liquidation of the company, who submitted a statement of affairs which showed ranking liabilities of £1,925. The assets totalled £201, from which had to be deducted £43 for preferential claims, leaving net assets of £158, or a deficiency, so far as the unsecured creditors were concerned, of £1,767. The issued share capital of the company was £3,360, and as regarded the shareholders, there was a deficiency of £5,127. The chairman reported that the company was registered on November 8th, 1922, with a nominal capital of £2,000. Later the capital was increased to £5,000, divided into 2,000 preference shares of £1 each and 60,000 ordinary shares of 1s. each. There had been issued 1,410 preference shares and 39,000 ordinary shares. All the preference and 33,000 of the ordinary shares were issued for cash. The remaining 6,000

ordinary shares were allotted as fully paid in consideration of a working agreement which was entered into with Electrical Installations, Ltd. The books of Wireless Service, Ltd., were incomplete, and only approximate figures could be presented, whilst no deficiency account had been prepared. A balance-sheet prepared as at December 31st, 1923, showed that since the inception of the company there had been a loss on the trading of £2,632. Since January 1st of last year, including depreciation, there had been a further loss on the trading of £2,494. The directors attributed that loss to the heavy initial expenses incurred in starting the business, high overhead charges, the extra expense involved on the installation of wireless apparatus, owing to the lack of knowledge on the part of the company's customers, and the reduction of the discount allowed by the N.A.R.M.

It was stated that the company at one time had a branch at Tunbridge Wells, but that was sold. The largest creditors took proceedings against the company, and attempted to levy execution, but could get nothing. Mr. Wells said he understood that goods had been ordered for the Tunbridge Wells business through Wireless Service, Ltd., and certain creditors might not know who their claim was really against.

A resolution was passed in favour of the appointment of Mr. E. H. Hawkins, of 4, Charterhouse Square, E.C., as liquidator of the company. The following are creditors :—

	£		£
General Wireless, Ltd.	741	Sun Electrical Co., Ltd.	30
Marconiphone Co., Ltd.	376	Moore, H. P., and W. H. Merriman	28
Radio Communication Co., Ltd.	127	Radio Instruments, Ltd. ...	25
Watkins, Eustace, Ltd.	111	Autoveyors, Ltd.	23
General Electric Co., Ltd. ...	97	Hart Collins, Ltd.	20
Stevens, A. J., & Co. (1914), Ltd.	41	Creditors under £20	237
British Thomson-Houston Co., Ltd.	76		

B. Barnett (Electrical Engineers, Leyton), Ltd., late Romford Road, Forest Gate, Essex.—A meeting of creditors was held on April 8th, at the offices of Messrs. Squire, Smith and Wilson, accountants, 149, Farringdon Road, E.C. No statement of affairs was presented, but Mr. M. J. Wilson, the liquidator in the voluntary liquidation of the company, stated that as far as he could ascertain there was not sufficient information in the books to enable a detailed statement of affairs to be prepared. The liabilities might be taken at something like £1,000, and, in addition, there was a debenture for £400. A valuation had been made of the stock, which was set down at £280, and apparently that was the whole of the assets. The company had a nominal capital of £1,000, but apparently nothing had ever been issued. The directors of the company appeared to have been Mrs. C. Barnett and Mr. W. Symons. The first meeting of the shareholders of the company was held in September, 1923, when Mr. B. Barnett was appointed as the secretary.

Mr. E. Judd, of Corfields Traders' Association, said that the company was registered on September 21st, 1923, to take over the business previously carried on by B. Barnett (Electrical Engineers), Ltd. The latter were to be allotted 400 shares of £1 each as fully paid. He asked if those shares were ever issued. The chairman stated that apparently they had never been allotted. There were debentures for £400, which were issued for cash, on April 15th, 1924. The debenture holder had appointed a receiver.

Mr. Judd asked why the present company was formed, and the chairman said he did not know. To the best of his knowledge the first company had never been wound up. He did not think there was any possible reason for the formation of the second company, but it took over the whole of the liabilities and assets of the previous one. The chairman, in reply to questions, said he believed that a petition for the compulsory liquidation of this company was dismissed. He thought a compromise was arrived at. Mr. Judd said he understood that the petitioning creditors were the Davis Electrical Co. and another firm who were then creditors. The chairman stated that he understood that the costs of the petitioning creditors were paid when the petition was dismissed, and they also received 7s. 6d. in the £ on the amount of their claims. The business previously carried on by the company had been sold by the receiver. The turnover of the company during a period of 16 months was approximately £18,000, but he could not say what rate of gross profit was made. The wages bill had been heavy, and had been as much as £50 a week. Mr. Barnett, as the manager, had drawn £8 weekly. He suggested that the meeting should be adjourned as he hoped than an offer of something like 5s. in the £ might be submitted to the creditors. After some discussion it was decided that a committee of the representatives of three of the principal creditors should be appointed to consider any offer which might be made. The committee appointed consisted of Mr. E. Judd, Mr. P. S. Booth, and Mr. A. Coward. Mr. Booth stated that if a satisfactory offer was not forthcoming he was in favour of a petition for the compulsory liquidation of the company being presented.

The principal creditors are :—

	£		£
Bennett Bros	26	Langham Electric Co.	21
Coward & Co.	33	Radio Press	23
Ebonite Parts Co.	46	Siemens & English Electric Lamp Co., Ltd	22
Gladding, T.	80	White, F. G.	70
Hackbridge Cable Co.	72	Lever, E. J.	64
Houghtons, Ltd.	282		

Napier-Kimber, Ltd., 6, Percy Street, W.1, and St. George's Hall, Bradford, wholesale electrical distributors and merchants.—A circular was issued last week to the creditors herein by Mr. H. Gillett, of Messrs. Dixon, Wilson, Tubbs & Co., 34, Basinghall Street, London, E.C., stating that by an Order made on March 24th Mr. Justice Romer had directed him to convene a meeting of the creditors for the purpose of ascertaining whether they desired that the company should be wound up by the Court or that the voluntary winding up of the company should continue either with Mr. Gillett or some other person as liquidator. The meeting was to be held yesterday (Thursday). The judge's order was made on the hearing of a petition for the winding-up of the company by the Court presented by Messrs. Johnson & Phillips, Ltd.

Hamilton Bros., Ltd., radio dealers, Cheapside, and Queen Victoria Street, E.C.4.—A meeting of creditors was held on April 8th, at the Institute of Chartered Accountants. The chair was occupied by Mr. H. Lever, C.A., who had been appointed to act as the receiver for the debenture holder, and also as the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed liabilities of £6,429, of which £6,278 was due to the trade and £151 to a cash creditor. The assets were estimated to realise £3,436, from which had to be deducted £132 due for preferential claims, and £1,013 outstanding on debentures. The net assets therefore were £2,291, or a deficiency as regarded the creditors of £4,138. The chairman stated that the company was registered on July 24th, 1923, with a nominal capital of £500 in £1 shares. The first directors were Mr. W. A. Cecil and Mr. M. Bolsom, and they were each entitled to £6 a week. Accounts were prepared for the years trading up to July 31st, 1924, and they showed a net profit of £126. Between August 1st, 1924, and the liquidation of the company, there was a net loss on the trading of £4,601, which accounted for the present deficiency. The debenture was created on January 27th last for £1,000, when cash to that extent was advanced by Mrs. Cecil, the mother of one of the directors.

Mr. P. S. Booth said he understood that the two directors were also the members of a board of another company, and he asked whether there had been any dealings between the two concerns. The Chairman said that the other company was now a creditor in Hamilton Bros., Ltd., for rather more than £500. There had been various transactions between the two companies. A creditor said that he had received four cheques from the two companies which were signed by the same people. The cheques from the other company were met, but those given on behalf of Hamilton Bros. were dishonoured. Mr. De Meza, solicitor, who appeared for the directors, said that the other company carried on a wholesale business, and had supplied Hamilton Bros., Ltd., with quantities of goods.

Mr. E. Judd pointed out that Hamilton Bros., Ltd., appeared to have sold goods at less than cost prices, and the chairman answered that the accounts certainly supported that contention. The two directors of the company each held five shares. There were the two signatory shares, and the debenture holder held the remaining 488 shares.

A question was asked as to whether the debenture holder would withdraw her claim, and the chairman replied in the negative.

Mr. M. Bolsom, one of the directors of the company, stated that they had had no connection with another company which had carried on business in South London, and he knew nothing whatever about a wireless firm in the provinces.

It was decided that Mr. P. S. Booth, accountant, of Kimberley House, Holborn Viaduct, E.C., should be appointed to act as joint liquidator of the company, while a committee was also nominated consisting of the representatives of the Igranic Electric Co., Ltd., East London Rubber Co., J. Pedley & Son, Siemens & English Electric Lamp Co., Ltd., A. J. Stevens and Co., Ltd., and S. G. Brown, Ltd. The following are creditors :

	£		£
Houghtons, Ltd.	591	Dunlop Rubber Co., Ltd. ...	41
Igranic Electric Co., Ltd. ...	572	J. W. B. Wireless Co., Ltd. ...	40
Siemens & English Electric Lamp Co., Ltd.	560	Garrett, White & Poland ...	45
Dawson Bros., Ltd.	540	Ripaults, Ltd.	40
Stevens & Co.	458	Eagle Transfer, Ltd.	44
Brown, S. G., Ltd.	310	Oldham & Son, Ltd.	43
Hough, E., Ltd.	292	Rothermel, R. A., Ltd. ...	41
Robinson, L., & Co.	248	Calmont, King & Co., Ltd. ...	40
Sterling Telephone & Electric Co., Ltd.	122	Derry Bros.	40
East London Rubber Co. ...	119	Max Steine	39
Dubilier Condenser Co., Ltd. ...	113	Paté Frères Pathéphones, Ltd.	37
New London Electron Works, Ltd.	108	Edison Swan Electric Co., Ltd.	35
Marconiphone Co., Ltd. ...	103	Cossor, A. C., Ltd.	33
Smith & Co. (Gramophones), Ltd.	91	Mullard Radio Valve Co., Ltd.	34
Hall & Brennard, Ltd.	87	Cuthbe, C. I., & Co.	32
Brown Bros., Ltd.	78	Harrison, J., & Sons, Ltd. ...	30
Clayton Rubber Co., Ltd. ...	76	Radio Communication Co., Ltd.	26
Telegraph Condenser Co., Ltd.	71	Zeitlin, V., & Sons	25
Pedley, J., & Son, Ltd.	62	Empire Wireless Service ...	25
Siemens Bros. & Co., Ltd. ...	59	Fellows Magneto Co., Ltd. ...	24
Preen, A., & Co., Ltd.	55	Wolff, M. & A.	23
British Thomson-Houston Co., Ltd.	54	Graham, A., & Co.	23
Fonteyn, Gilbert & Co., Ltd.	50	Autoveyors, Ltd.	23
		Bergongnan Tyre Co., Ltd. ...	21
		Sun Electrical Co., Ltd. ...	21
		Tungstalite, Ltd.	210
		Rent	47

Carey, Stickley & Woodroofe, Ltd., 21, Bennetts Hill, Birmingham, builders and contractors, and wireless and electrical engineers.—The first meeting of the creditors of the above was held recently at the Official Receiver's offices, Birmingham. According to the statement of affairs there was a deficiency of £1,825. It appeared that the company was incorporated on February 25th, 1924, with a nominal capital of 1,000 ordinary shares of £1 each, of which 829 were issued. The company acquired a wireless and electrical business, the assets taken over being valued at £750. The business proved unsuccessful, and was discontinued, the company starting

building operations. The failure of the company was attributed to heavy losses incurred in the wireless business and losses on building contracts, coupled with lack of capital. Mr. J. M. McKenzie, of Colmore Row, was appointed Liquidator, with a committee of inspection.

Fallon Condenser Manufacturing Co., Ltd., White Ribbon Works, Broad Lane, Tottenham, N.—A further meeting of creditors was held recently at the offices of Messrs. C. H. Travis & Co., C.A., Moorgate Station Chambers, E.C. The chair was occupied by Mr. R. H. Dutchman, who said that, in accordance with the resolution passed at the last meeting, the liquidator appointed by the shareholders had resigned, and a further resolution had been passed appointing him to act as liquidator. Since his appointment he had continued the business, but had very considerably curtailed the expenses, and had executed a number of orders at the usual prices. There were numerous complaints received regarding certain of the goods manufactured by the company. Condensers were being returned daily on the ground that they were defective. According to the books, there was a surplus of assets over liabilities, but he had prepared an approximate statement of affairs which disclosed a deficiency of about £2,000. In answer to questions, the chairman stated that the company issued a debenture, but it was paid off some time ago. He did not think that he would be able to make up the large stock of uncompleted parts, but that matter could be considered by a committee of the principal creditors. A resolution was passed confirming the voluntary liquidation of the company with Mr. Dutchman as liquidator, and it was stated that application was being made to the Court for the appointment of a committee of inspection.

Electrolite, Ltd.—A petition for the winding up of this company has been presented to the County Court of Surrey by Richard Feuer & Co., Gesellschaft fur Gasgluhlicht Industrie, M.B.H., and will be heard at the Croydon County Court on April 29th.

Summers Electric & Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. B. Darke, 146, Bishopsgate, E.C.

Wireless Valves, Ltd.—A meeting of members is called for May 18th at the offices of Messrs. Blakemore, Edgar & Co., 9, King's Bench Walk, Temple, to hear an account of the winding up from the Liquidator, Mr. G. W. Vinson.

Wireless Experts, Ltd.—A meeting of creditors is called for April 20th at the Hotel Belgravia, Grosvenor Gardens, S.W.

Electrical Services, Ltd.—A meeting of members is called for May 16th, at 48, Sunbridge Road, Bradford, to hear an account of the winding up from the Liquidator, Mr. P. Hodgkinson.

Dissolutions of Partnership.—The Kine-Radio Co., scientific and wireless instrument manufacturers and kinematograph engineers, 146, Sunbridge Road, Bradford.—Mr. A. Sykes, Mr. F. Harwood, Mr. F. Needham, and Mr. J. Robinson have dissolved partnership. Debts will be attended to by Messrs. Sykes, Harwood, and Needham, who will continue the business under the same style.

Hodge & Co., gas and electric light fittings and chandelier manufacturers, College Works, Summer Hill, Birmingham.—Messrs. J. E. Vicars and Mr. C. Stamps have dissolved partnership. Mr. Stamps has taken over and will continue the business.

Robinson & Badman, electrical engineers, 88, Western Road, Southall.—Mr. V. Badman and Mr. A. T. Robinson have dissolved partnership.

Whiteside & Thompson, wireless engineers, Castle Street and Castlegate, Clitheroe, Lancs.—Mr. J. W. Whiteside and Mr. B. Thompson have dissolved partnership. Mr. Thompson, Castlegate, Clitheroe, will attend to debts and continue the business.

C. F. Howden & Co., electrical installation contractors, 104, Renfrew Street, Glasgow.—Mr. C. F. Howden and Mr. J. H. McMorrine have dissolved partnership. Mr. Howden will attend to debts. Mr. McMorrine will continue the business under his own name at the same address.

Private Arrangements.—J. N. Macdonald and W. H. Wilkinson, wireless manufacturers, trading as J. Macdonald and Co., 2, High Street, Camden Town, N.—A meeting of creditors was held on April 7th at the offices of Messrs. Thorpe and Pearson, accountants, 5, John Street, W.C., when a statement of affairs was submitted which disclosed liabilities of £2,067, of which £1,337 was due to the trade and £730 to cash creditors. The assets totalled £274, from which had to be deducted £32 for preferential claims, leaving net assets of £242, or a deficiency of £1,825. Mr. Pearson stated that the debtors were school teachers, and they started trading in partnership in March, 1923, at Theobalds Road. They had a weekly tenancy of one room, which was used as a stock room, and also had the use of another room as an office. They attended to the business in their spare time. The debtor Macdonald obtained orders to the extent of more than £1,000. They had intended doing a small wholesale and mail order business, but in view of the orders received they altered their plans. They had to obtain loans from friends in order to carry out the orders. Finally, the orders rose in value to over £3,000, on which it was anticipated that a net profit of £800 would be realised, but eventually the orders could not be carried through. Larger premises became necessary, and they agreed to pay a premium of £400 for the lease of the Camden Town establishment. At that time the debtors did not assemble or manufacture their own goods. Substantial orders which they received could not be completed owing to the faulty character of the goods delivered to them. It had been hoped that a large order of something like £10,000 would come from Australia. There were still possibilities of that order being received, and it would mean a profit of about £3,000. Early in March the debtors executed a deed of assignment. The present position was principally due to the fact that the debtors could not give their undivided attention to the business.

It was decided to confirm the deed already executed to Mr. Pearson, subject to the cash creditors withdrawing their claims until the trade creditors had received 5s. in the £. A committee was also appointed, consisting of Mr. E. H. Hawkins (Messrs. Foppleton, Appleby & Hawkins) and the representatives of the cash creditors, the Clayton Rubber Co., Ltd., W. H. Briscoe & Co., Ltd., and T. Sykes Dunhill, Ltd.

Radiophones, Ltd., 4a, Savoy Hill, W.C.2.—A further meeting of the creditors in this matter was held on April 7th, when the chair was occupied by Mr. C. Frey, representing the Anglo-Swiss Screw Co., Ltd., the largest trade creditor. Mr. Frey reported that the committee appointed at the last meeting had investigated the book debts and had taken a full note of the stock, and after careful consideration the committee recommended the creditors to accept a composition of not less than 10s. in the £. A resolution was passed that the creditors should be recommended to accept (1) a payment within one month of 10s. in the £ cash, or (2) a composition of 12s. 6d. in the £ payable as to 5s. in cash at once and the remaining 7s. 6d. by three instalments to be suitably guaranteed to the committee of inspection.

T. H. Joyce, trading as T. & H. Joyce, 210b, Shaftesbury Avenue, W.C., electrical and wireless factor.—A meeting of creditors was held on April 8th, at the offices of Mr. Simon Burns, solicitor, 32, Gresham Street, E.C., when the chair was occupied by the representative of the Dubilier Condenser Co. Mr. Osborne, of Messrs. Corfield & Cripwell, presented a statement of affairs which showed liabilities of £2,531, all due to unsecured trade creditors. The net assets were given as £461, or a deficiency of £2,070. Mr. Osborne said that no proper books had been kept, and it had been impossible to prepare a trading account. The debtor commenced business in May, 1922, with a capital of £150. In the following February he was joined in partnership by a Mr. Crotchley, and he paid in £280. In 1923, Crotchley left the business, and a Mr. Speed took his place, paying Crotchley £250. Mr. Speed retired in December, 1924. The debtor had drawn about £5 a week from the business. The largest creditor was the Ego Engineering Co. It appeared that the company was registered in the name of the debtor's wife. The debtor was asked if the Ego Engineering Co. would be prepared to withdraw its claim. Mr. Joyce said he could not answer that at present. It was eventually resolved that a composition of 5s. in the £ be accepted, to be paid within 14 days, the last 2s. 6d. to be guaranteed.

The following are creditors:—

	£		£
Arrigoni, C. J.	60	Metro-Vick Supplies, Ltd. ...	400
Behr, N.	71	McMichael & Co., Ltd.	36
Brown, S. G.	82	Portable Utilities Co., Ltd. ...	78
Dubilier Condenser Co.	380	Odham's Press	27
Ego Engineering Co.	528	Bretwood, Ltd.	68
Graham, A., & Co., Ltd. ...	82	Radio Communication Co., Ltd.	206
Hughes, F. A., & Co., Ltd. ...	45	Skipton & Co., Ltd.	32
Igranic Electric Co., Ltd. ...	122	Trader Publishing Co., Ltd. ...	28
Lighting, Heating & Glass Co., Ltd.	64	Vandervell, C. A., & Co., Ltd.	69
		Watmel, Ltd.	35

Trade Announcements.—B. M. A. S., Ltd. (formerly Runbaken Magneto Co.), Trafford Park, Manchester, has opened a branch factory and store at 13-27, Sackville Street, Belfast, where it intends to stock a complete line of accessories and to carry spare parts for every known make of battery, magneto, dynamo, and starter.

The Magneto, Accumulator & Electro Plating Co. has moved into new premises in Leafield Road, Dumfries. A radio department is run in conjunction with the company's battery service station.

Mr. D. Cattermole has opened a radio business at Mildenhall (Suffolk).

Messrs. Cecil Hodges & Co., Ltd., inform us that they have secured sole selling representation and manufacturing rights for the "Vereecke" patent windmill for generating electric power.

Messrs. Symper & Evershed are transferring their business to larger premises at 22-24, Greenhill Parade, Harrow.

Messrs. Pritchett & Gold & E.P.S. Co., Ltd. (with whom are incorporated Messrs. Peto & Radford), state that upon the resignation of Mr. A. W. Reeves they have relinquished their offices at Edmond Street, Birmingham, and have appointed Mr. W. E. Fletcher as their representative in the Midlands for the sale of their radio and automobile batteries.

The South Metropolitan Electric Traction & Lighting Co., Ltd., has taken premises at 47, Woodcote Road, Wallington, which will be opened, after alterations, for the supply of electrical fittings, accessories, and lamps.

The business of Burndept, Ltd., having been acquired by the new company, Burndept Wireless, Ltd., as stated in our last issue, the accounts due to, and the liabilities of, the former company will be dealt with by the latter, which is continuing the business under the same management, but under the new name. The recent issue of capital was largely oversubscribed.

Catalogues and Lists.—THE EAST LONDON RUBBER CO., 29-33, Great Eastern Street, E.C.2.—A very comprehensive catalogue (164 pp.) of radio sets, components and accessories. Each item is illustrated and the price is given.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflets No. 304/1-1, dealing with automatic main field breaking equipment; No. 272/1-1, describing the "Type IS" three-pole rotary isolating switch; No. 82/2-1a, illustrating lever-switch type motor control panels; and 276/1-1, dealing with the "Vickers" ironclad lever switch-fuse.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—April stock list of motors and dynamos.

ELECTRIC HEATING & HARDWARE, LTD., Crown Works, Berkley Street, Birmingham.—An illustrated and priced pamphlet advertising "Glowincoal" electric fires.

ASH'S MANUFACTURING CO., 66, Blackfriars Road, S.E.1.—An illustrated pamphlet advertising electrically-operated ice cream freezers and ice crushers.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Price List A 2,010, containing illustrations and full details of air-break circuit breakers, classes "S.K.A." and "S.K.B."

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—An illustrated folder advertising the "Boyce Moto Meter" and other automobile accessories.

THE AIREDALE ELECTRICAL & MANUFACTURING CO., LTD., 392, Bowling Old Lane, Bradford.—Leaflet No. 25/6, illustrating and describing air- and oil-break combined stator and rotor starters for two- and three-phase slip-ring motors.

New Indian Company.—The Sree Meenakshi-Sundaieswaral Electric Power Corporation has recently been formed at Trichinopoly, Madras, with a capital of 300,000 rupees.

Book Notices. — "Low Temperature Distillation," by S. H. North and J. B. Garbe. Pp. vii + 216; figs. 40. London: Sir Isaac Pitman & Sons. Price 15s. net.

"Kempe's Engineer's Year Book, 1925."—32nd edition, edited by H. R. Kempe and W. H. Smith. London: Crosby Lockwood & Son. Price 30s. net.

Scientific Papers of the United States Bureau of Standards. No. 495, "A Radiometric Investigation of the Germicidal Action of Ultra-Violet Radiation" (20 cents); No. 496, "Effect of Stress on the Magnetic Properties of Steel Wire" (5 cents); and No. 498, "Tables for the Calculation of the Mutual Inductance of Circuits with Circular Symmetry about a Common Axis" (10 cents). Washington: Government Printing Office.

British Empire Exhibition.—The special devices to be used in illuminating the "Garden of Eden" at the Wembley Exhibition this year, mentioned in our columns of March 27th, are the products of Mr. Chas. Selz, 83, George Street, Portman Square, W.1, to whom the whole scheme of decorative illumination for the "Garden of Eden" has been entrusted. The illuminated parrots and owls, and many other animals of all descriptions, frogs and penguins on the lawns, and fishes and swans on the lakes, &c.. are all to be illuminated in accordance with the scheme of Messrs. Sparks and Partners. As the special devices are completed they are being conveyed from Mr. Selz's premises to Wembley, a motor-lorry load at a time.

Recent Contracts.—Among the orders recently received by the MIRRLEES WATSON CO., LTD., are the following:—Two evaporators for the Dalmarnock (Glasgow) power station, and two for the Carlisle Corporation: borehole pumps driven by vertical electric motors, including one 7-in. pump to deliver 36,000 gallons per hour and one 5-in. pump to deliver 20,000 gallons per hour; and three 12-in centrifugal pumps for the Wigan Corporation to deliver 3,000 gallons per minute against a head of 40 ft.

Our Foreign Trade.—MARCH FIGURES.—The following were the values of imports and exports of electrical goods and machinery during March, 1925:—

	Mar., 1925.	Inc. or dec.	3 months, 1925.
Imports.			
Electrical goods and apparatus	£ 332,745	+ £ 113,064	+ £ 433,046
Machinery	1,075,459	+ 259,855	+ 641,215
Exports.			
Electrical goods and apparatus	914,292	+ 225,165	+ 697,767
Machinery	4,172,585	+ 954,494	+1,994,370
Re-exports.			
Electrical goods and apparatus	14,933	+ 7,572	+ 23,725
Machinery	123,290	+ 26,895	+ 89,302

Electric Cranes at a Locomotive Works.—The London, Midland and Scottish Railway Co. is installing large electrically-driven overhead cranes in its locomotive works at St. Rollox, Glasgow. These cranes, which will each have a lifting capacity of 50 tons, will handle with ease the heaviest type of present-day engine, and their use will help to reduce appreciably the time spent on repair jobs. The contract for the cranes has been placed with Sir William Arrol & Co., Ltd.

Radio Apparatus for South Africa.—The *British South African Export Gazette* says that the progress of the wireless goods trade continues, and the demand on the part of the public is increasing monthly. In every part of the Union, and in Rhodesia as well, the demand for receiving sets, constructors' parts, &c., is advancing rapidly, and no British firm of wireless goods manufacturers can afford to neglect what is to-day in many respect the most valuable Dominion market for wireless apparatus of every description.

Swiss Ignition Apparatus Works Sold.—The business of the Scintilla Gesellschaft, of Solothurn, makers of ignition magnetos and lighting and starting sets for motor cars has, we understand, been purchased from Brown, Boveri & Co., of Baden, by a syndicate of Belgian motor car manufacturers. Among the directors of the new company, which has a capital of 3 million francs, is M. de Jong, of the Minerva Motor Co., Antwerp.

Australian Tariffs.—In February last an application was made to the Australian Tariff Board for the removal or reduction of the duty on locomotives and portable and other oil engines. One engineer and importer asked for the removal of the duty on electric storage battery locomotives equipped with nickel-iron batteries. This application was opposed by a representative of the English General Electric of Australia, who said that such locomotives could be and had been made in Australia for the past 12 years. Several locomotive manufacturers asked for the duties on imported locomotives to be increased rather than decreased.

New Belgian Company.—Radio A. C. T. I. is the style of a company formed at Antwerp (33-35, Rue Loos), with a capital of 1,000,000 fr., for the manufacture and sale of radio apparatus.

Cement Works Contracts.—*The Times Trade and Engineering Supplement* states that Messrs. Edgar Allen & Co., Ltd., have recently received several important orders for cement works plant. One of these is for the provision of a complete electrically-driven plant for the Dunstable Portland Cement Co., with a capacity of 110,000 tons per annum. Another electrically-driven plant is being supplied to the Standard Portland Cement Co., of New South Wales. This plant will have an output of 100,000 tons per annum, and the waste heat will be recovered for use in the generating plant boilers. Other contracts of a similar nature have been placed with the firm by the Sulphide Corporation, of New South Wales, and the Gillingham Portland Cement Co., Kent.

Birmingham Street Lighting.—The Birmingham Corporation has decided to install electric lighting in one of its main thoroughfares, Broad Street, in which the Hall of Memory (The City of Birmingham war memorial) is situated. The contract, comprising ornamental cast-iron lamp standards, 20 ft. and 9.5 ft. high, with brackets and lanterns, has been received by the Cable Accessories Co., Ltd.

Electrical Goods for Guatemala.—According to a French official report the electrical machinery principally in demand in Guatemala is 0.5 to 50-kW dynamos, 0.5 to 2-h.p. single-phase, 110- to 220-V motors, 3 to 15-h.p., three-phase, 220-V motors, and 2,200-V motors of 20 h.p. and over. There is also a sale for 30 to 200-kW, three-phase alternators, and for single-phase transformers from 1 kW to 100 kW. Wires and cables of all dimensions from 1 to 2 millimetres insulated for 600 V are required. For factory installations many electrical accessories are needed, *e.g.*, insulating tubing, insulators, and lightning arresters; whilst for household use there is a sale for Edison screw fittings, switches, fuse boxes, roses, &c. Heating devices of all kinds are also beginning to be sold. The principal competition is between the Germans and Americans; French electrical material is not being imported in large quantities yet. Conditions of sale are cash against shipping documents. Packing should be effected with great care owing to the likelihood of frequent transhipment.

Factory Electrification.—THE LANCASHIRE DYNAMO AND MOTOR COMPANY, LTD., has secured the contract for the complete electrification of Cairds (Dundee), Ltd., Craigie Works, Dundee. The plant comprises a number of large motors, including "Maxtorq" motors up to 90 h.p., and a "Lancashire" self-starting synchronous motor of 160 b.h.p., to be used for driving the factory and improving the power factor of the whole installation. Some of the motors, including a 160-b.h.p. motor, drive through laminated steel gears. The total rating of the installation is 910 b.h.p.

A Report upon the Engineering Industry.—We have received from the British Engineers' Association a copy of the report upon the present condition and future prospects of the engineering industry which was presented to the Committee on Industry and Trade by the Director of the Association, Mr. D. A. Bremner, O.B.E. The report emphasises the important nature of the engineering industry, and the necessity for a large export trade. Discussing the causes of the present depressed state of the industry it attributes this to a number of factors, including the restriction of output and hours; the attempt of our people to live on a higher economic plane than is justified by their annual output of new values; the burden of taxation; and the intervention of too many non-producers between the manufacturer and the producer. Other causes beyond the internal ones are stated to be high Customs tariffs, depreciated currencies, and unfair foreign competition in the home market. The future prospects of the engineering industry will depend partly on political, industrial and financial developments abroad, and partly on the action taken at home to remove or counteract the causes of depression within our own control. "Our share of world trade in manufactured articles will inevitably depend on the relative efficiencies of ourselves and our competitors. At present the balance is against us, and to redress it either our efficiency must rise or theirs must fall."

German Machinery for a Scottish Firm. — Mr. D. N. Dunlop, Director of the British Electrical and Allied Manufacturers' Association, writing to the *Glasgow Evening News* recently, says that the increasing tendency to place orders for machinery with German firms is illustrated by a case which has occurred in the Clyde area during the past few weeks. He states:—"The Summerlee Iron Company placed an order for two 1,000-kilowatt, mixed pressure turbo-alternators and jet condensers with the German General Electric Company. I understand that of all the tenders received, including tenders from Scottish firms, that of the German General Electric Company was the second highest in the list, and there was therefore no advantage in placing an order with that firm. Even after the German tender was reduced on the recommendation of the Summerlee Company, it was still higher than the lowest British tender." After stating that there can only be one of two reasons for such an action, *viz.*, lower price or higher efficiency, Mr. Dunlop continues:—"On the admission of German engineers themselves, this last contention cannot be upheld, and so we are now confronted with the spectacle of a Scottish firm dependent for the great part of its output on orders from British firms deliberately encouraging German production. If this had been a single instance with no precedent, some excuse might have been possible for the firm, but the policy practised consistently by it has been to place orders with the German General Electric Company, 11 turbine sets out of the 14 installed in its works being supplied by the German General Electric Company. The effect of such a policy on British industry at this time of depression can well be imagined."

"Marconi" Valve Cartons.—The General Electric Co., Ltd., informs us that in order to facilitate the selection of "Marconi" valves when they are ordered, each different pattern is now packed in a carton of a distinctive colour. For instance, the "R.5" type has a yellow carton, the "D.E.R." pattern a pink one, &c.

Unemployment.—There was a decrease of 7,015 in the number of registered unemployed during the week ended March 30th. The total at that date was 1,194,300, as compared with 1,058,273 in March, 1924.

Chinese Notes.—An electric light plant is being constructed at Taianfu (Shantung province), a town of 25,000 inhabitants.

An application for permission to build an electric railway between Ihing and Changchow, a distance of 90 li (52 km.), has been made by Chu Nan Chiang of Ihing (Kiangsu province).

South Africa and Imperial Preference.—The Cape Town correspondent of *The Times*, in a review of the Budget proposals for the ensuing year by the South African Government, states that the whole Customs tariff is to be revised on the following principles:—The protection of Union industries; the admission free of duty, or at the lowest possible rate, of the raw materials of industry; and the adjustment of the present Imperial preferential tariff on a *quid pro quo* basis. The existing rebate is entirely withdrawn on articles in which Great Britain holds a predominant market, or where a proprietary name or trade mark is a determining factor in the sale of any article. While the rebate is thus withdrawn in some cases, in others it is retained, and even increased from the present rate of 3 per cent. to rates ranging from 5 to 10 per cent. Mr. Havenga, in announcing the Government's policy, estimated that under the revised scale the total annual rebate will be approximately £300,000 to Great Britain and £50,000 to the Dominions, as compared with £860,000 and £90,000 respectively last year.

A *Daily Mail* correspondent says that the new tariff permits British electric lamps to enter free, while electric heating and cooking appliances will be allowed a 5 per cent. rebate.

Electrical Imports into New Zealand.—The *Board of Trade Journal* states that the preliminary trade returns for 1924 show that the value of electrical plant and machinery imported into New Zealand during the year increased by £607,570 over the previous year's figure.

New Municipal Showrooms.—The extensions and showrooms at Edwards Lane, Stoke Newington, are to be officially opened on May 28th.

Calendar.—We have received from the British Electric Plant Co., Ltd., Alloa, a calendar consisting of a large card bearing illustrations of the company's pumps and motors, a humorous drawing by Mr. Heath Robinson, and two-monthly slips for the year ending February, 1926.

Social Event.—The series of dances arranged during the season by the staff of Messrs. Johnson & Phillips, Ltd., terminated on April 3rd in a very successful fancy dress ball, held at the Woolwich Town Hall. Prizes were presented by Mrs. J. Macgregor and Mrs. C. Stewart on behalf of the donors, the Australian branch of Messrs. Johnson & Phillips, Ltd.

German Progress in Heating and Cooking Apparatus.—The Syndicate of Electric Cooking and Heating Appliances of Charlottenburg, Berlin, has established a large display of its apparatus at the Cologne Fair. At a private view Herr Ritter, of Berlin, stated that the industry originated in the 'nineties of the past century; a great development took place in 1905 and continued until 1914, when some 500 workmen were employed on it. After the stagnation during the war a fresh impetus began in 1920 and at the present time the number of workmen engaged in the construction of heating and cooking appliances is 20,000, turning out from 10,000 to 12,000 articles per day.

Finnish Machinery Imports.—According to a report in the *Board of Trade Journal*, machinery and apparatus of a total value of 261.5 million Finnish marks, was imported into Finland during 1924. The previous year's figure was 291.3 million marks.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 8th:—

Polar Blok. No. 440,800. Class 8; and Polar. No. 442,693. Class 8. Apparatus and instruments for use in radio-telegraphy and telephony.—Radio Communication Co., Ltd.

Excellaite. No. 452,677. Class 8. Headphones for use in radio-telephony.—The S. D. H. Manufacturing Co., 24, Stoke Newington Road, N.16.

Mahoganite. No. 453,058. Class 8. Fitted panels for use in connection with instruments and apparatus used in radio-telephony and telegraphy. No. 453,410. Class 50. Electrical insulating substances.—The American Hard Rubber Co., 11, Mercer Street, New York. (British agents: Haseltine, Lake and Co., 28, Southampton Buildings, W.C.2.)

Unitex. No. 454,635. Class 8. Aerials for radio-telegraphy and telephony.—E. Marsden & Co. (Derby), Ltd., Springfield Works, Sandiacre, Nottingham.

Felix Crystal Keeps on Talking. No. 456,509. Class 8. Apparatus for radio-telegraphy and telephony.—L. A. C. Lawler, trading as "Lawler's Electrics," 67, Lucien Road, S.W.17.

Rexite (lettering and design). No. 454,777. Class 8. Crystals for use in radio-telephony.—F. H. Fry, 22, Chestnut Avenue, Walthamstow.

Rextone. No. 454,917; and Etheron. No. 454,918. Class 8. Instruments and apparatus for use in radio-telephony and telephony.—W. G. Conway, 88, Chancery Lane, W.C.

Bercliff. No. 455,632. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Simmonds Bros., Shireland Road, Smethwick, Birmingham.

Tower Brand (lettering and design).—No. 456,374. Class 8.—Radio-telephone apparatus and parts therefor.—Alfred Bowman, trading as the Tower Radio Supply Co., 35-37, Norton Folgate, E.1.

Key Design. No. 451,347. Class 13. Electrical switchboards (ordinary), electrical fittings, &c.—Selfridge & Co., Ltd.

Correction.—In our issue of April 3rd (p. 535) the trade mark registered by Mr. Alfred Barson (Leicester) in respect of radio apparatus, was given as "Stadiovox"; the correct term is "Stradivox."

For Sale.—By order of the Receiver, Mr. A. C. Vincent, of Mechanical Ads., Ltd., Messrs. W. B. Hallett, Fox & White will sell by auction on April 23rd, at 230 and 232, Holloway Road, N., the stock of advertising equipment, lamps, &c. By order of the Purfleet Wharf & Sawmills, Ltd., Messrs. Fuller, Horsey, Son & Cassell, will sell by auction on May 8th, at the Baltic Exchange, gas electric power plant, &c., standing at Purfleet Wharf. (For particulars see our advertisement pages to-day.)

Licensing of Contractors in India.—With a view to avoiding dangers resulting from imperfect electrical installations, the Government of Bombay has decided to license wiremen and electrical contractors. A Central Board of Examiners has been constituted for the purpose, and only those who have passed the tests imposed by the Board will be given the necessary licence. The certificates are classified as "higher" and "lower."

Lighting and Power Notes.

Accrington.—Electricity Extensions.—The Town Council has approved extensions to mains, switchgear, &c., in connection with a bulk supply to the Lancashire Electric Power Co., the expenditure on which will be £7,771. A further expenditure of £5,462 is proposed for additional plant to meet the increased demand for bulk supplies from Haslingden Corporation and other demands *en route*.

Algeria.—Electricity Scheme.—A scheme is under consideration for the establishment of plants to utilise the water power of the River Haut Cheliff between Boghan and Lavigerie, Algeria, for irrigation and hydro-electric purposes. It is proposed to dam the river at five places.

Bexhill.—Correction.—In our report of the negotiations for a bulk supply from the Hastings undertaking to Bexhill (Elec. Rev., April 3rd, p. 536) it was stated that the price originally quoted was £4 10s. per kVA, plus 8d. per kWh, and that this was subsequently reduced to £3 10s. per kVA, plus 4d. per kWh. The "unit" charges should have been given as 0.8d. and 0.4d. per kWh respectively.

Bradford.—Electricity Extensions.—The Electricity Committee has approved the laying of an additional e.h.p. feeder between Valley Road and Bolton Road works, at an estimated cost of £1,724, and has authorised application for sanction to a loan. The Committee has also recommended an expenditure of £20,000 on mains extensions.

Loan Sanctioned.—The Committee has received sanction to the borrowing of £1,000 in respect of land and building for switch-house and transformer chambers at Dudley Hill.

Broadstairs. — Electricity Charges. — The Ministry of Transport has issued an Order authorising the Isle of Thanet Electric Tramway & Lighting Co., Ltd., to increase the charge for electricity from 6d. to 8d. per kWh. The Company has agreed to renew the public lighting contract with the Urban District Council for the coming year on the same terms as those already in force.

Canterbury.—Loan.—The Town Council has applied for sanction to a loan of £3,500 for the provision of a new feeder cable from the electricity works to Wincheap Street.

Chesterfield.—Electricity Supply.—The Corporation is to provide a sub-station and e.h.p. cable for a new ice factory in Markham Road, and to extend cables in Clifton Street and Hope Street. A sub-station is to be erected and cables laid for the supply to the Derby Road area.

Croydon.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £60,000 for a new boiler and generating plant at the electricity works. Mains extensions to cost £5,398 are to be shortly carried out.

Continental.—POLAND.—The report of the Société d'Entreprises Electriques en Pologne for the past year shows that good progress is being made, the number of consumers of the affiliated undertakings having increased from 14,530 at the end of 1923 to 18,423, representing an advance in connections from 9,139 to 11,268 kW. The company is in negotiation for a number of additional electricity supply concessions and for the establishment of several regional power stations in various important industrial districts.

ITALY.—The Société Générale Elettrica del Adamello is establishing a new hydro-electric station in the Camonica Valley, and also a new reserve steam-operated station of 20,000 kW capacity. The capital of the concern is being increased from 160 to 200 million lire.

BELGIUM.—In the report of the Société Bruxelloise d'Electricité for 1924, just issued, it is stated that work is well in hand on the extension of the plant at the central station in Brussels from 16,500 to 23,000 kW. The sales of electricity for the past twelve months show an increase of 24 per cent. over 1923, and in view of the increasing demand a further extension of the plant will shortly have to be considered.

The reports of the various electricity supply undertakings which have lately been issued show that notable progress is being made in all parts of Belgium in the demand for electricity. The Société Intercommunale Belge d'Electricité now owns eight generating stations, and is making further extensions which will bring its plant up to a total capacity of 180,000 kW and its 50,000- and 70,000-V transmission lines up to a length of 178 miles. The Société d'Electricité du Bassin de Charleroi, whose distribution system now extends to a total length of 762 miles, reports that 96 per cent. of the increased demand last year was for power purposes. The Société d'Electricité du Borinage, which now supplies current to 132 communes, has increased its distribution mains to just over 600 miles. During the year the Société d'Electricité du Nord de la Belgique, which is now supplying 93 localities, completed the installation of 50,000-V transmission lines between Louvain and Tirlemont and between Malines and Baestrode.

Durham.—CHANGE-OVER.—The City Council has granted permission to the County of Durham Electrical Power Distribution, Ltd., to change over to a.c. the system of supply for the remaining portion of the city.

Eastbourne. — ELECTRICITY EXTENSIONS. — The Electricity Committee is to reconstruct the Sidley Road sub-station and has purchased sites for sub-stations at Ringwood Road and Rodmill Road. The Committee also has under consideration the extension of the electricity works.

Gillingham (Kent).—LOAN.—The Town Council has applied for sanction to a loan of £15,000 for services, cables, showrooms, central offices, and sub-station, and to pay off a bank overdraft of £2,000.

India. — PUNJAB HYDRO-ELECTRIC SCHEME. — The Punjab Legislative Council has sanctioned the Mandi hydro-electric scheme after considerable discussion. The project was prepared over a year ago and since then it has been under careful examination by Government experts. As it is a very costly scheme involving a total cost of Rs. 5½ crores, which it would not be possible for a private company to raise in the Punjab, it has been thought better not to entrust the project to private enterprise, and it has been undertaken by Government itself.

Indo-China.—ELECTRICAL DEVELOPMENT.—The Société Indo-Chinoise d'Electricité, in its recently-issued report, mentions that new agreements running until the end of 1937 have lately been concluded for the supply of electricity to the towns of Hanoi and Haiphong, and that to meet the increasing demand an additional 1,500-kW turbo-generator is being installed and a contract arranged with the Société Industrielle de Chimie d'Extrême Orient for a supplementary supply from the latter's power station. To take the latter, a new main is at present being laid and a 300-kW converter installed. The Indo-Chinoise Company has also secured concessions to establish generating stations in the towns of Nain Dinh and Haiduong, and a contract for one in Laokay, together with the reorganisation of the existing distribution system, in the last-named town.

Leeds.—LOANS.—The Corporation has received sanction to the borrowing of £5,000 for sub-station buildings, and is applying for a further loan of £50,000 for services required during the next few years. A site has been purchased in Roundhay Road for a sub-station.

Lyme Regis.—NEW PLANT.—A report has been presented to the Town Council by the engineers in charge of the new electricity scheme, Messrs. R. W. Weekes and Hudson, pointing out that owing to the rapid growth of the undertaking there would be an inadequate standby should the present set have to be shut down during the winter. They therefore recommend the installation of further plant at an estimated cost of £2,900.

Maidenhead.—ELECTRICITY IN BULK.—The Town Council has approved of an agreement, recommended by the Electricity Committee, with the Metropolitan Electric Supply Co., Ltd., providing for a supply of electricity in bulk, and also the rearrangement of the present plant, which will entail an expenditure of £5,900 in the course of two years. The scheme is to be submitted to the Electricity Commissioners for approval.

Mid-Lancashire Electricity Advisory Board.—At a recent meeting of the Board, at Burnley, consideration was given to electrical development schemes at Darwen and Clitheroe. Both matters were referred to the Engineers' Advisory Committee for consideration and report.

North Wales and Cheshire Joint Electricity Authority.—The quarterly meeting of the Authority was recently held at Llandudno, when the following reports were submitted:—

Special Orders.—A sub-committee has been appointed to deal with the applications for Special Orders for the supply of electricity in Prestatyn, Bethesda, and Portmadoc.

The General Purposes Committee stated that transmission lines completed now extend to Holywell, Wrexham, Crewe and Runcorn. Sub-stations have been erected at Bangor, Marconi wireless station, Carnarvon, Rhuddlan, and Wrexham, and a contract has been placed for the erection of a sub-station at Crewe for a supply to the L.M. & S. Railway Co.

Maentwrog Power Station.—A complete survey of the work has been completed, and engineering details of the installation of generating plant are now under consideration.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

RATHMINES (Co. DUBLIN).—Lighting: From 8d. to 7d. per kWh. Outside lighting for public buildings, kinemas, &c., From 6d. to 5d. per kWh. Heating, cooking and domestic purposes: From 3d. to 2½d. per kWh. Power for industrial purposes: From 2½d. to 2d. per kWh.

GILLINGHAM.—Lighting: Maximum demand rate, from 10d. and 3½d. to 10d. and 3d. per kWh; flat rate, from 8d. to 7d. per kWh; prepayment meters, from 9d. to 8½d. per kWh.

BOGNOR.—*The Bognor Gas Light and Coke Co.*—Lighting: From 9d. and 8d. to 8d. and 7d. per kWh. Power: From 4d. and 3½d. to 3d. and 2½d. per kWh.

CHESTERFIELD.—Lighting: 5½d. per kWh. Heating, cooking, &c.: 1d. per kWh. These charges are subject to a discount of 5 per cent. for prompt payment of accounts. The rent for meters in private houses has been reduced to 2s. per quarter.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has approved extensions and works at an estimated cost of £6,545, and extensions of mains for general distribution purposes at an outlay of £10,493.

Skegness.—PROPOSED ELECTRICITY SCHEME.—The National Electric Construction Co., Ltd., has submitted a scheme to the Urban District Council for the supply of electricity in the district. It is proposed to give a bulk supply from the company's power station at Boston. Electricity would be transmitted to the boundary of the Council's area at a pressure of 11,000 V. The estimated cost of the construction of a sub-station in Boston and the erection of the transmission lines to the boundary is £22,000. The cost of a sub-station, and the laying of mains in Skegness is estimated at £14,000. The Council has decided, subject to certain conditions, to raise no objection to the company's application for an Order to supply electricity to the district.

Special Orders. — Applications have been made to the Electricity Commissioners for Special Orders to supply electricity in the following districts:—Whitchurch and Ellesmere urban and rural districts, by Gwynedd Trust, Ltd.; Wellington (Somerset) urban district, by Messrs. Crompton & Co., Ltd.; Gainsborough, by the Urban District Council.

Southport.—ELECTRICITY CHARGES.—The Electricity Committee has adopted, as from April 1st, the following special inclusive domestic tariff:—Fixed quarterly charge: Up to and not exceeding five rooms 15s., for each additional room 3s., payable in advance. 1d. per kWh will be charged for all electricity used in the residence subject to a quarterly minimum payment for this purpose of 1s. per room per quarter. The tariff is optional and an alternative to the flat rates for domestic lighting and heating. The Committee has also recommended the following reductions:—Domestic lighting: Flat rate from 6d. to 5d. per kWh. Domestic power and heating: 1½d. per kWh for the summer quarters and 1¾d. per kWh for the winter quarters, as compared with 1¾d. per kWh throughout the year. Special reductions have also been made in the charges for lighting and power to business premises.

Stretford.—ELECTRICITY SUPPLY.—At a recent meeting of the Electricity Committee, Mr. J. A. Robertson, consulting electrical engineer to the Urban District Council, reported good progress with the 33,000-V transmission line from Barton power station to Mosley Road sub-station. The new-type joint boxes were in course of manufacture and should be ready to permit jointing immediately after the cable was laid. Arrangements had been made with the Manchester Corporation to connect up the additional transmission line to the 33,000-V system at Barton power station.

LOANS.—Application is to be made for sanction to the following loans:—£15,000 for l.p. mains, services, &c., for Stretford, Old Trafford, and Trafford Park; £5,000 for e.h.p. mains.

Tonbridge. — ELECTRICITY IN BULK. — The Urban District Council has decided to negotiate with the Tunbridge Wells Corporation for a bulk supply of electricity, and the electrical engineer, Mr. Plunkett, has been instructed to proceed with the specifications for the necessary converting plant and mains with a view to inviting tenders.

Tramway and Railway Notes.

Bradford.—Railless Cars.—The City Council, on April 7th, referred back the Tramways Committee's recommendation to substitute railless-car services for the present tramway system on the Idle and Thackley sections.

Continental.—Spain.—Good progress is being made on the work of construction of the electric railway from Vigo to Ramallosa and the tramways from that point to Gondomar and Bayona. The permanent way has been prepared, and the laying of the rails and the erection of the overhead lines is in hand, and it is expected that the line will be completed by the end of the current year.

The Compañia del Tranvia urbano de Bilbao has applied for sanction to build a new electric tramway in the city to link the Gran Via de Lopez de Haro lines with those of the Avenida de Mario Arana.

Czecho-Slovakia.—It is announced from Prague that the contract for the electrification of the first section of the Czecho-Slovakian State railways has been placed with the Krizik Electrical Co., of Prague, working in conjunction with Brown, Boveri & Co., of Baden, Switzerland.

Kingswinford.—Proposed Abandonment of Route.—The Minister of Transport recently held an inquiry into the application of the Dudley, Stourbridge and District Electric Traction Co. for sanction to abandon its tramway in the Kingswinford area. The company states that the decision has been made because the tramway does not pay.

London.—Through-running.—In connection with the scheme for the through running of tramcars from the Embankment to Purley, the reconstruction of the track between Norwood and Purley has now been completed by the Croydon Corporation, but as regards the provision of the cars for the through-running, 25 of which were to be supplied by the Corporation and 35 by the London County Council, the Corporation has intimated that it is not prepared to spend £79,000 for the provision of cars, and has asked the L.C.C. whether it would lend the necessary number. Subject to certain conditions, the Highways Committee of the L.C.C. has recommended that the Council should agree to provide the cars.

Traffic Restrictions.—It is reported that the London Traffic Committee has under consideration the terms of a new Order for the further restriction of omnibus traffic. It is proposed that after the date of the Order no addition shall be allowed to the omnibus fleets on any routes where there are tramways. This would mean a scheduling of about 650 streets as streets which would be barred to any new omnibuses which the London General Omnibus Co. or proprietors outside the combine might desire to introduce.—*Evening News.*

United States.—Municipal Ownership Rejected.—The Chicago Municipal Council recently conducted a referendum to decide whether the tramways and elevated railways of the city should be acquired by the City. The result was a large majority against the proposals.

Telegraph and Telephone Notes.

Denmark.—Telephone Development.—The Copenhagen Telephone Co. is negotiating with an American banking firm for a loan of $3,000,000 (£600,000), and the conclusion awaits the final decision of M. Stauning, the Danish Prime Minister. The loan will be used for the extension of the company's service, says *The Times*. The question of establishing a telephone service between Copenhagen and London has been discussed by the Danish Telegraph Authorities and the British General Post Office. The project presents considerable difficulty.

Holland.—Investigation Committee.—The special committee appointed to inquire into the State management of the Dutch post, telegraph, and telephone services recently reported to the Minister of Waterstaat on the working of the powerful wireless station recently erected at Kootwyk. The committee urges that the State management of this station should cease, and that it should be placed in the hands of a private company as a concessionary. This station is intended especially to provide radio communication with the Dutch East Indies.—*Reuter* (Amsterdam).

Hong-Kong.—Radio on Ships.—A report has been issued by the Colonial Office of a conference on piracy near Hong Kong, which was the outcome of representations made by the organisations of shipmasters, navigating and engineer officers, says the *Daily Mail*. The conference recommends that the fitting of wireless apparatus and the carrying of trained operators should be obligatory on all ships subject to the piracy regulations, and that the Admiralty should be asked to consider what steps should be taken to render the naval vessels patrolling the danger zone continuously able to receive distress calls from river steamers.

The Telephone Service.—Progress in Liverpool.—A report by Mr. W. J. Medlyn, M.I.E.E., superintending engineer, P.O. Engineering Department, South Lancs. District, on telephone progress in the Liverpool district (including Warrington, St. Helens, and the Isle of Man), shows that the number of telephones was 53,414 in 1924, an increase of 53 per cent. in twelve years. During last year 6,610 new telephones were fitted, or an average of nearly 130 per week; deducting cessations, this gives a net increase of 3,809, the gross and net figures constituting the highest record for the twelve years' period. For the four months ending January 31st, 1925, the net increase was 1,381, or at the rate of 4,143 per annum. In twelve years the total underground wire mileage rose to 175,825, an increase of 77 per cent. The greatest density occurs between Liverpool, Warrington, and Manchester, where there are 452 underground lines, of which 379 are already in use and 73 are available for further growth of traffic, in addition to large extensions of the underground systems serving local subscribers. Concurrently, overhead wires are being recovered, and, since 1912, 8,052 miles of open wire in the district have been cut down. Nine complete new exchanges and two new rural exchanges have been established, in addition to extensions of existing equipment. In the Liverpool district alone the increase in telephone traffic between 1923 and 1924 amounted to 10 per cent. In the latter year 52¼ million local effective calls, 3¼ million trunk calls, and 186,000 phonogram calls were handled. The expansion of the "junction" services may be gauged from the fact that in 1914 subscribers could obtain "on demand" 28 exchanges; in 1924 the number had been raised to 350.

"Area Transfer."—An "area transfer" involving about 1,800 London telephone subscribers' lines was begun on April 2nd and, says *The Times*, is the largest operation of the kind so far undertaken. The object is to connect subscribers in every case with the nearest exchange, a necessary step towards the automatic system. Most of the changes in this case affect the City area. Twelve hundred "Avenue" lines are being passed to the new "Royal" exchange, and 200 lines lately on the "City" and "Central" exchanges are going to "Holborn," from which a few "Holborn" lines have been transferred to "Central" during the last few days. Between 180 and 200 "Maida Vale," "Speedwell," and "Willesden" lines are being taken over by "Hampstead," and 263 subscribers formerly on "Finchley," together with ten from "Barnet" and a few others from "Edgware," are now connected with the new "Mill Hill" exchange, opened on April 2nd, which has equipment for 591 subscribers and capacity for extension to 2,680. Six other new exchanges (in some cases new buildings accommodating existing exchanges) will be opened during the next few months—namely, "Palmer's Green," "Tilbury," "Albert Dock," "Enfield," "East Ham," and "Sloane," which will relieve one of the most congested exchanges in London, "Victoria," and will also take lines from "Kensington" and "Western."

Directory Cost.—According to an answer in the House of Commons, it cost about £41,500 to print and distribute the last issue of the London telephone directory; the advertisement receipts amounted to £23,450.

Persia.—New Radio Stations.—It is reported that a beginning was made on March 24th at Kassra-Kadjar, about four miles from Teheran city, with the erection of a radio station, the first of seven to be constructed by the (Russian) Central Electrical Trust in Persia.

Radio Notes.

International Bureau.—Geneva Clearing House.—At the conference of representatives of European broadcasting organisations, held in London at the invitation of the British Broadcasting Co., it was decided that an International Broadcasting Bureau should be set up at Geneva. For the oversight of the affairs of this Bureau a committee of nine was appointed, and at a meeting of the Committee at Geneva representatives from the following countries were present:—Belgium, Czecho-Slovakia, France, Germany, Great Britain, Holland, Norway, Spain, and Switzerland. The Bureau is to be a clearing house for information, and will also be charged with the responsibility for negotiations in connection with the interchange of programmes and the settlement of technical and programme difficulties. Mr. A. R. Burrows, who has been connected with the B.B.C. as its director of programmes from the outset, has been appointed Bureau manager, and has accordingly resigned his position with the B.B.C. Many of his duties will be taken over by Mr. C. A. Lewis.

Tuning Note.—Revision.—The new tuning note which 2LO has used recently has not proved popular. Although a piano scale may be advantageous to listeners who use large sets, the average user is content with the "squeak," to which the London station has returned.

Aerial Mishap.—The aerial of the Liverpool station, 6LV, recently broke away from the chimney stack to which it was attached and fell 250 ft. to the ground.

United States.—Unification Scheme.—A new broadcasting scheme to cover all America is announced. Four linked stations, at Chicago, New York, Los Angeles, and a place to be decided upon, will cover the entire country. According to the *Daily News*, the scheme is in the hands of Mr. Hearst, who will put his newspaper resources behind it, and Mr. Joseph Schenck, the kinema and entertainment magnate, who will provide the amusement features.

Several schemes to put broadcasting on a proper basis are now being considered by the United States Government, says the *Evening News*. That which finds most favour is the charging of a tax of 8s. on each valve and 2s. on every crystal set sold. Should the scheme be adopted, it will come into operation next October. The Government will take over those

it requires of the existing broadcasting stations and build others as needed. Those not wanted will eventually be shut down.

Wireless Telegraphy Bill.—CONFERENCE.—At the invitation of the Postmaster-General, representatives of the Radio Association, the Institution of Electrical Engineers, the Royal Society, and other bodies interested, met at the General Post Office to discuss the new Wireless Telegraphy and Signalling Bill last week.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argyll.—The County Education Authority is inviting tenders for an electric lighting installation at a new school at Kinlochleven. Particulars from Mr. R. Cameron, master of works, Education Offices, Dunoon.

Australia.—SYDNEY.—June 4th (extended from May 14th). Postmaster-General's Department. Accumulator and counter e.m.f. cell batteries.*

June 11th. Motor-generator sets for the Randwick, Waverley, Gordon, and City East telephone exchanges.*

May 4th. Municipal Council. 5,000-V potential transformers.—*Reuter's Trade Service* (Melbourne).

July 8th. New South Wales Government Railways. Two coal elevators and the maintenance of the whole equipment for 12 months.*

MELBOURNE.—May 6th. Victorian Government Railways. High-speed turbine lathe, portable petrol engine-driven electric welding plant.*

Bournemouth.—May 21st. Tramways Department. Two 750-kW geared turbines and d.c. generators, complete with condensing plant. (See this issue.)

Bristol. — May 12th. Electricity Department. Two water tube boilers complete. (See this issue.)

Carlisle.—April 27th. Electricity Department. Steam, feed, blow-out and other steel pipework. (April 10th.)

Chile.—SANTIAGO.—July 1st. Ports Commission. Eight electrically-operated travelling portal cranes for the Port of San Antonio.*

Dundee.—April 24th. Electricity Department. E.h.p. and l.p. cable. (April 10th.)

Finland.—HELSINGFORS.—June 1st. Finnish Water Power Department. Two 75-ton overhead travelling cranes, electrically operated.*

Hindley.—April 27th. Urban District Council. Platt Low Level Sewerage Scheme. Electric motors, pumps, &c. Particulars from O. P. Abbott, surveyor, Council Offices.

India.—April 21st. India Store Department. Motor converters. April 28th. Electric ceiling fans. April 30th. Porcelain insulator cups. May 5th. 150-kVA steam-driven alternator sets, a.c. and d.c. switchboard for power station. (April 10th.)

Ilford.—April 28th. Electricity Department. Supply of 660-V paper-insulated cables. (See this issue.)

London.—H.M. OFFICE OF WORKS.—April 24th. Supply of mechanical and electrical engineering labour during three years in Leeds, Newcastle, and Southampton. (April 3rd.)

METROPOLITAN ASYLUMS BOARD.—April 22nd. Installation of c.b. battery telephone switchboard and certain additions to the fire alarm system at the South-Eastern Fever Hospital, New Cross. (April 10th.)

April 27th. Installation of electric lighting, new main switchboard and power cables, &c., at the Grove Park Institution, Lee, S.E. (April 10th.)

May 20th. General engineering work, installation of four new Lancashire boilers, fuel economiser, brickwork settings, laundry machinery and plant, electrical generating plant, motors, and power wiring at the Leavesden Mental Hospital, King's Langley. (See this issue.)

New Zealand.—WELLINGTON.—June 9th. Post and Telegraph Department. Metallic two-wire plugs for telephone switchboards.*

Stoke-on-Trent.—Electricity Department. Plant and materials for a water-pumping scheme, including pumps, cast-iron piping, valves, chlorinating plants, &c. (See this issue.)

York. — April 24th. Electricity Department. Two 25,000-lb. water-tube boilers, economisers, fan chimneys, &c., one 1,500-kW rotary or motor converter, with switchgear, one 1,000-kW motor-generator and switchgear. (April 3rd.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Aberdeen Ice Co.
Condensers for power factor improvement.—Telegraph Condenser Co., Ltd.

Australia.—MELBOURNE.—City Council. Accepted:—
47,000 yd. triple braided cable (£630).—Enfield Cable Works (Australia), Ltd.

Melbourne and Metropolitan Board of Works. Recommended:—
Electric cable for pumping station at Spotswood (£396).—British Insulated and Helsby Cables, Ltd.

SYDNEY.—Electricity Supply Committee. Accepted:—
Small shackle l.p. insulators (£562).—British General Electric Co., Ltd.—*TENDERS.*

Adwick.—Urban District Council.
Cable (in connection with the bulk supply of electricity from the Brodsworth and Bullcroft Collieries) (£2,007).—Callender's Cable & Construction Co., Ltd.

Ashford (Kent).—Urban Council. Accepted:—
Overhead crane (£205).—Herbert Morris & Co.
Power house (£2,058).—H. Knock.

Belgium.—Two British firms—the British Insulated and Helsby Cables, Ltd., and Callender's Cable & Construction Co., Ltd.—submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for underground and sub-river cables in connection with the electrification of the Antwerp - Wommelghem, Antwerp-Wyneghem-Schilde, and Merxem-Schootenhof local railways. Quotations were also received from four Belgian concerns. The offers ranged from 737,368 to 950,992 francs, the lowest being that of the Société des Ateliers de Constructions Electriques de Charleroi.

Bedford.—Electricity Committee. Accepted: —
Cable for 12 months.—Siemens Bros. & Co., Ltd.
Pipework for connecting new boilers and turbines (£960).—Aiton & Co., Derby.

Birmingham.—Board of Guardians. Accepted:—
Electric lighting installation at Selly Oak House (£5,598).—T. Glover.

Burton-on-Trent.—Electricity Committee. Accepted:—
Cable.—Johnson & Phillips, Ltd.

Carlisle.—Electricity Committee. Accepted:—
Repairs to traction battery (£286).—Pritchett & Gold & E.P.S. Co., Ltd.
Recording instruments for boiler-house equipment (£891); extension to conveyor house (£185).—Sterling Boiler Co., Ltd.
Pipes (£108).—Aiton & Co., Ltd.
Small valves (£664).—J. Hopkinson & Co., Ltd.
One battery (£570).—Tudor Accumulator Co., Ltd.
Installation of internal telephones (£276).—Western Electric Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
E.h.p. cable.—Pirelli-General Cable Works, Ltd.
L.p. cable.—Western Electric Co., Ltd.
Maconite overhead distributors and service cables and joint boxes.—Macintosh Cable Co., Ltd.

Croydon.—Board of Guardians. Accepted:—
Electrical goods.—Baxter & Caunter.

Hull.—Telephones Committee. Accepted:—
Wall instruments (£350).—Automatic Telephone Mfg. Co., Ltd.
Cords (£77).—British L. M. Ericsson Mfg. Co., Ltd.

Town Council.—Water-tube boilers and accessories for the Electricity Department:—

Vickers-Spearing Boiler Co., Ltd. (incomplete)	£71,095
Babcock & Wilcox, Ltd. (Accepted.)	**71,245**
Stirling Boiler Co., Ltd.	71,730
Clarke, Chapman & Co., Ltd.	77,832
Richardsons, Westgarth & Co., Ltd.	85,603
Vickers & International Combustion Engineering Co. (powdered fuel)	110,005

Leeds.—Baths Committee. Accepted:—
Installation of electric lighting at Meanwood Road baths (£261).—Cropper and Hancock.

Sewage Committee. Accepted:—
Power line in connection with sewage distribution (£856).—Wilson Hartnell Installation, Ltd.

Tramways Committee. Accepted:—
Traction lamps for 12 months.—Siemens & English Electric Lamp Co., Ltd.

Rotherham.—Electricity Committee. Recommended:—
3,000 yd. e.h.p. cable (£1,462).—Callender's Cable & Construction Co., Ltd.
E.h.p. switches.—General Electric Co., Ltd.
1,500-kVA transformer (£362).—Fuller Electrical Co.
Service cable (£286).—General Electric Co.
De-aerating plant (£1,066).—Hick, Hargreaves & Co., Ltd.

Tramways Committee. Recommended:—
Electrical equipment of tramcars.—English Electric Co., Ltd.

Sheffield.—Tramways Committee. Accepted:—
High-speed slotting machine (£390).—Butler Machine Tool Co., Ltd.

Sunderland.—Corporation. Accepted:—
Air compressor.—Tilghman's Patent Sand Blast Co., Ltd.

Swansea.—Electricity Committee. Accepted:—
Water valves (£206).—Alley & McLellan, Ltd.
Steam valves (£220).—Dewrance & Co.

Torquay.—Electricity Committee. Accepted:—
Pipework for extensions to Newton Abbot power station (£2,030).—Babcock & Wilcox, Ltd.

Electricity on Board Ship.

The World's Largest Motor Liner.*

THAT the year 1925 commenced with very satisfactory prospects for the motor shipbuilding industry is indicated by the fact that there are internal-combustion-engined vessels of over 1,000,000 tons gross under construction.

The largest, fastest, and highest-powered motor ship built last year was the 18-knot 18,500-ton gross liner *Aorangi*, built by the Fairfield Shipbuilding and Engineering Co., of Govan, for the Union Steam Ship Co., of New Zealand. That the placing of the order for such a liner created a sensation throughout the shipbuilding industry is not surprising when it is remembered that up to that time the biggest motor ship that had been constructed was a vessel 485 ft. long, equipped with machinery of 4,500 b.h.p., whereas the *Aorangi*, fig. 1, is a quadruple-screw first-class passenger liner 600 ft. long, with a beam of 72 ft., displacing 23,000 tons and propelled by oil engines developing 14,500 s.h.p. on trial.

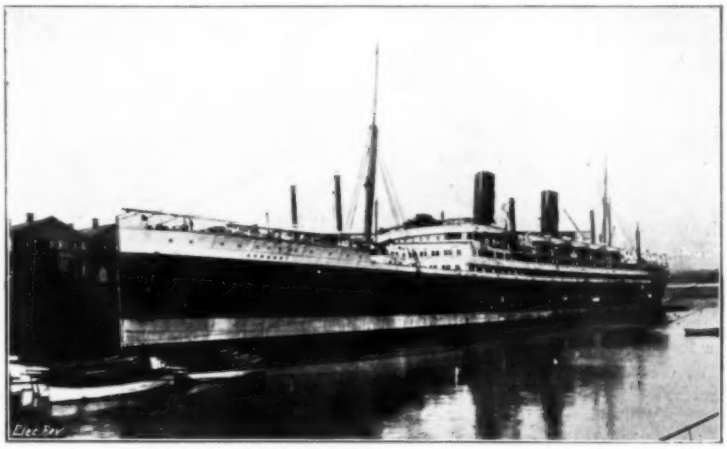


Fig. 1.—The Motor Passenger Liner, "Aorangi."

The vessel is, of course, electrically lighted throughout, and all the auxiliaries for each engine are separately driven, either by steam engines, electric motors, or compressed-air engines. The main bearings and crankpins are lubricated by means of electrically-driven Weir bucket pumps, and the used oil is passed through magnetic strainers and an electrically-driven Sharples centrifugal separator with a capacity of 300 gallons of lubricating oil per hour. The lubricating oil in the auxiliary engine-room is dealt with separately by a De Laval separator. For filling the tanks with lubricating oil there is provided a Stothert & Pitt self-contained electric Feuerheerd pump; sea-water is employed for all cooling purposes; it is pumped overboard by bilge pumps on one side of the ship of an electrically-driven Weir type, and on the other side by a Thom Lamont pump, which is steam-driven.

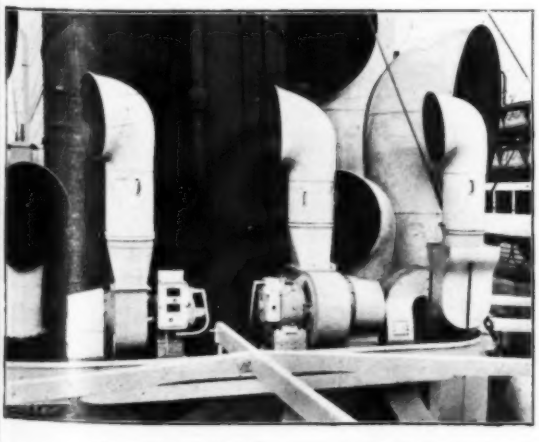


Fig. 2.—Ventilating Fans on the Boat Deck.

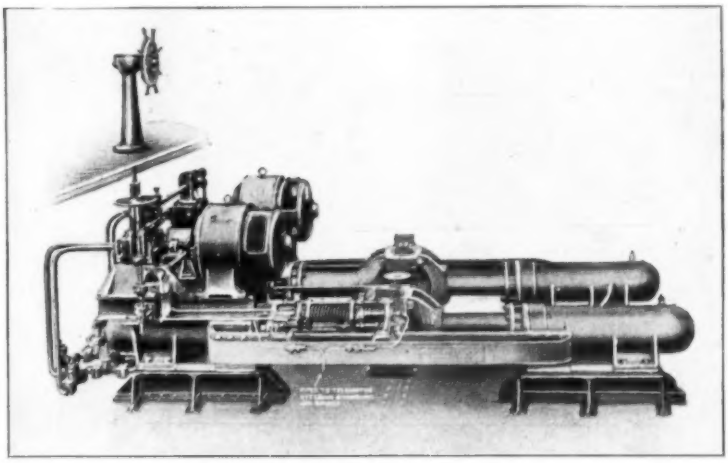


Fig. 3.—Electro-hydraulic Steering Gear.

The pumps used for the main jacket water (one on each side of the engine-room) are of the Drysdale upright type, driven by 70-h.p. vertical electric motors.

The electrically-operated scavenging turbo-blowers are believed to be the largest yet built. A separate starting panel is provided for each motor, close to the machine and near the engine control station. The direct-current motors, fig. 4, of the Brown, Boveri type, are of 430 b.h.p., and during trials they have run up to 3,150 r.p.m., although the usual speed will probably be from 2,000 to 2,600 r.p.m. The two electrically-driven auxiliary compressors, operating at 1,000 lb. per sq. in., are three-stage Reavell machines, running at 400 r.p.m. and coupled to 67-h.p. Allen motors, with speed variation between 340 r.p.m. and the maximum. The emergency bilge pump is of the Drysdale submersible vertical type, with a capacity of 140 tons per hour, driven by an 18-h.p. motor, and will run even if submerged, the controls being located well above the engine-room level.

The auxiliary engine-room accommodates four 400-h.p. Diesel-driven generators and two boilers, in addition to their accessories and a number of pumps. There are two generators in each wing, with the two boilers between them; three sets will always be in operation at

*For some of the data and illustrations embodied in this article we are indebted to the courtesy of the *Motor Ship*.—EDS. ELEC. REV.

sea. The Allen generators are driven by two-cycle Sulzer Diesel engines.

The auxiliaries in this compartment include two 5-in. upright Drysdale sanitary pumps, each delivering 100 tons hourly, and driven by a 24-h.p. vertical motor, fig. 5. There is also an Allen steam-driven dynamo, with an output of 10 kW at 330 r.p.m.

In the auxiliary engine-room there are four electrically-driven fans which draw air from the atmosphere, and as the scavenging air for the auxiliary engines is taken direct from the engine-room, the ventilation should prove satisfactory. In the main engine-room there are two large electrically-operated fans at the forward end, which exhaust from the engine-room and discharge into the suction compartment of the turbo-blowers. There is also an exhaust fan at the after-end of the engine-room.

The steering gear is of the electro-hydraulic type, fig. 3, made by Messrs. Brown Bros. & Co., Ltd., and is capable of exerting an effort of 435 tons. It is operated by four hydraulic rams, arranged in opposing pairs, and the two constant-speed, non-reversing, electric motors are each coupled direct to a Williams-Janney variable-delivery pump.

The switchboard, fig. 6, is at the after-end of the auxiliary engine-room, occupying about half the width of the ship, and all the four generators may operate in parallel, but, if desired, one can be used for lighting and for supplying the steering gear, quite independent of the other three.

There are 26 power and nine lighting circuits connected to the switchboard, and, contrary to the system adopted in many ships, the lighting is at the full line voltage of 220. A battery of Chloride 14-cell 126-Ah accumulators is provided near the switchboard, so that, in the event of all the dynamos being accidentally shut down, a certain number of essential lights in the engine-room would immediately receive current from the battery, the change-over being automatic.

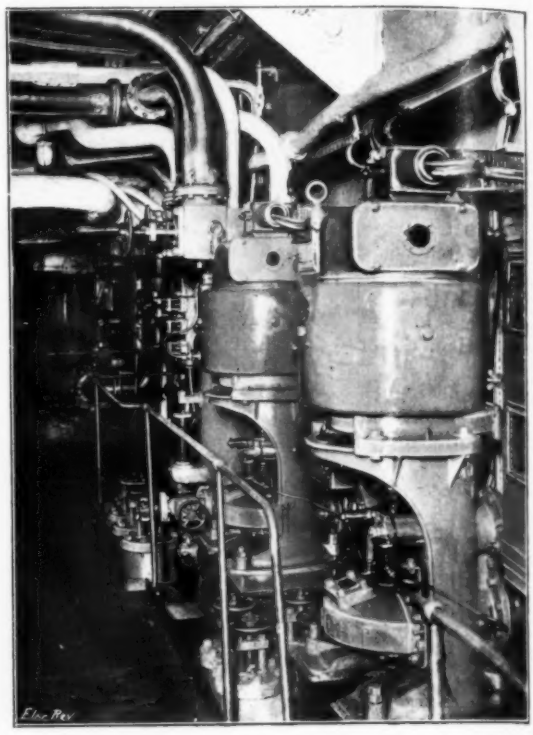


Fig. 5.—Two 24-h.p. Vertical Sanitary Pumps.

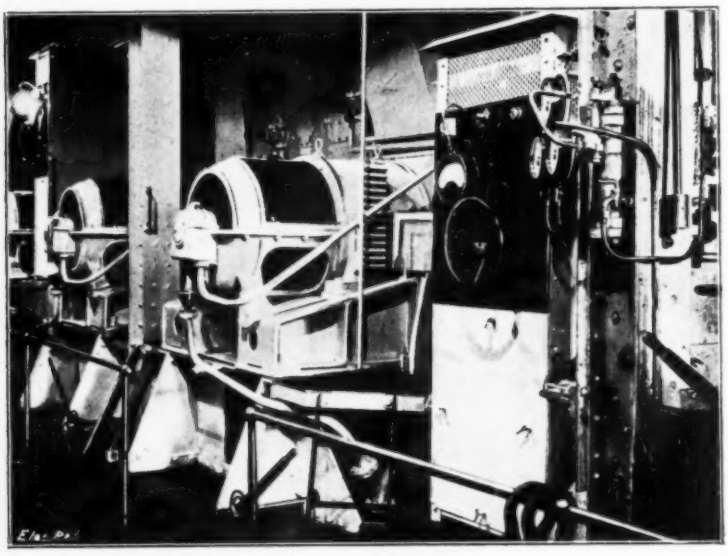


Fig. 4.—Three 430-b.h.p. Scavenging Blower Motors.

Several noteworthy items of the electrical equipment were supplied by the General Electric Co., Ltd., the most important part being the main switchboard, fig. 6, an excellent example, which consists of 15 slate panels for the control of the various machines and circuits, the voltage of which is 220. Four panels control the 300-kW d.c. generators, each being equipped with a triple-pole "Salford" circuit breaker, meters, &c., and two triple-pole switches; three panels control 450-h.p. turbo-blower motor circuits, being fitted with a double-pole "Salford" circuit breaker and ammeter. Another panel enables the power generated by the emergency set, right aft on the boat deck, to be brought on to the main busbars when required; it is equipped with double-pole "Salford" circuit breaker, ammeter, and voltmeter. The remainder of the panels control feeder circuits, of which there are four of 300 amp., four of 200 amp., 10 of 150 amp., and five of 100 amp.

The emergency board shown in fig. 7 is specially housed on the top deck with the emergency generator; it consists of three panels, one for the generator and the other two for feeders, the former being similarly equipped to those on the main board. The 36-kW dynamo is driven by one of the new airless-injection Sulzer-type Diesel engines, built by Messrs. Weir.

The bell indicator system throughout the vessel is of G.E.C. manufacture. There are in all 24 sub-indicators arranged in two groups, each under the control of a master indicator for the first and second class respectively. An illustration of a typical sub-indicator is seen in fig. 8.

The telephone installation, com-

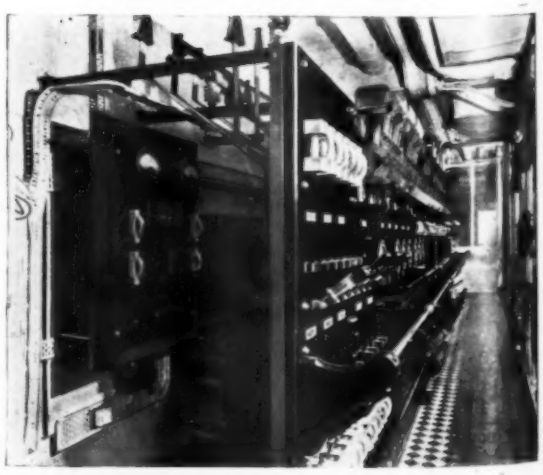


Fig. 6.—Main 220-volt D.C. Switchboard.

municating with all the principal officers of the ship, is a modern central-battery system of Peel-Conner manufacture. The switchboard, fig. 9, is operated on the lamp-signalling principle, and the equipment, comprising jacks, lamp socket mountings, keys, cords and plugs, &c., is all of standard design as used by the General Post Office. In some of the cabins telephones are fitted, communicating with the central exchange

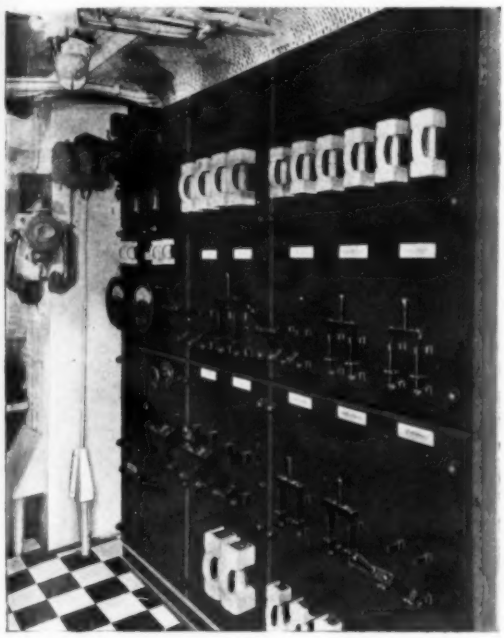


Fig. 7.—Emergency Board on Top Deck.

above mentioned, and there are also provided a number of loud-speaking telephones for navigational purposes, an enclosed telephone box being provided in the engine room.

It is perhaps not surprising that a broadcasting system has been provided, so that music, speeches, &c., can be transmitted from a central position to all the public rooms. Broadcast radio-telephone programmes from

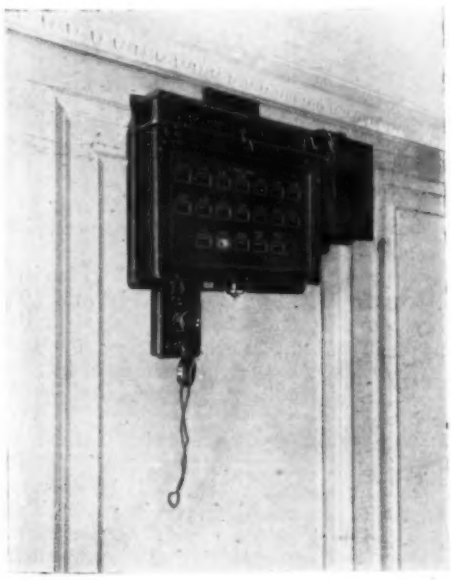


Fig. 8.—A Typical Bell Indicator.

shore stations will be received on the ship, and the "wireless" installation includes directional equipment. The installation, which has been supplied by the Radio Communication Co., comprises a 1½-kW transmitter, having a range of 800 miles, a continuous-wave transmitter with a range of 2,000 miles, and radio telephony apparatus for use between ship and shore, communicating up to 50 miles; 17 loud speakers are fitted.

In every cabin there is a fan, and heating in certain parts of the ship is effected by electric radiators; including the fans required for the ventilation of the machinery spaces, 61 of the Thermotank Co.'s type have been fitted. The galley was equipped throughout by Messrs. Henry Wilson & Co., Ltd., and electricity is utilised for a large number of purposes. For instance, in the bakery there is an electrically-heated baker's oven with a maximum consumption of 27 kW, an electric pastry oven, dough mixer, two electric grills (each 2 ft. 6 in. by 2 ft. by 6 ft. high, with a maximum consumption of 35 kW), electric salamanders, an electrically-driven mixing machine, besides toasters, hot-plates, potato peelers, dish washers, and mincing machines, all electrically-heated or driven. There are special pantries for the private dining room, the lounges, the smoking rooms and hospital, and these are equipped with electric grills, hot-plates, and coffee apparatus, &c.

Amongst the aids to navigation is a Sperry gyro compass, whilst the electric helm indicator is of the Siemens type and the bulkhead doors can be controlled from the navigating bridge or locally on the Stone system.

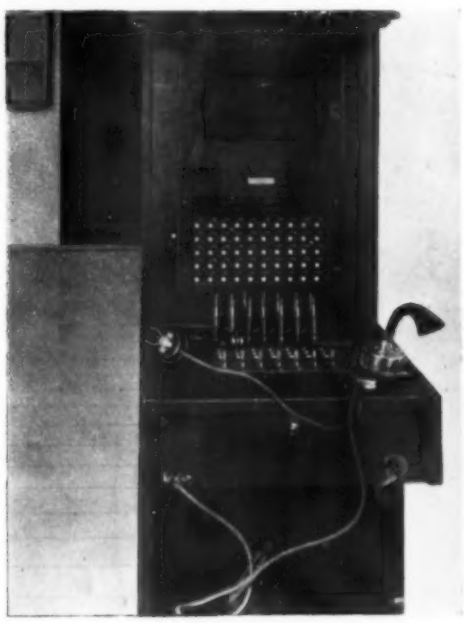


Fig. 9.—The Telephone Switchboard.

It is claimed that the laundry is one of the largest ever fitted on a ship. All the plant is electrically operated, and the washing machines, extractors, and drying tumbler are controlled from a central panel. On this, the controls are operated by a small pilot motor of ⅛ h.p., and are set so that no two machines start together, thus avoiding peak loads. The larger cascade is driven by a 3-h.p. motor, and takes a load of 300 lb. (dry weight), which will be washed and rinsed in a period varying from 30 to 50 minutes. The smaller machine is operated by a 1-h.p. motor, and each extractor is driven by a 3-h.p. motor with a maximum speed of 1,350 r.p.m. For the tumbler there are two motors—one of 1½ h.p. to drive the fans, and for the revolving cylinder a motor of 1 h.p. For the flatwork ironer a 3-h.p. motor is required, whilst the presses are driven by motors of ½ h.p.

An electrically-operated Furnival printing plant is installed on board, and two Smith, Major & Stevens electric passenger lifts provide communication between all decks right up to the boat deck. There are two pursers' stores hoists—special machines evolved for this particular purpose. The engineers have a special lift for taking them to the engine room. Throughout the ship, electrically-operated clocks are fitted.

Strowger Automatic Telephones Afloat.

An Admiralty Installation.

THE following description of an automatic telephone installation aboard an Admiralty vessel is of interest on account of its novelty.

Fig. 1.—H.M.S. "Dolphin" with Submarine Alongside.

Just prior to the war a Strowger automatic installation was ordered for the ill-fated s.s. *Britannic*. The

Fig. 2.—Strowger Automatic Switchboard and Batteries.

equipment was manufactured by Automatic Telephone Manufacturing Co., of Liverpool, and was on the point of being installed when the vessel was taken over by the British Admiralty and the project fell through.

During the war, in 1918, Automatic Electric Co., of Chicago, the American manufacturer of Strowger automatic equipment, fitted five United States battleships with Strowger installations, the vessels and their respective installations comprising:—

U.S. s.s.	*Camden*	50	telephones.
..	*Harrisburg* ..	24	..
..	*Orinaba*	30	..
..	*Siboney*	30	..
..	*Von Steuben* ...	22	..

The British Admiralty has now followed suit with an installation aboard H.M.S. *Dolphin*, a submarine depôt ship, which equipment was manufactured and installed for the Admiralty by Automatic Telephone Manufacturing Co., and gives full intercommunication between 24 telephones, which are of the usual standard desk

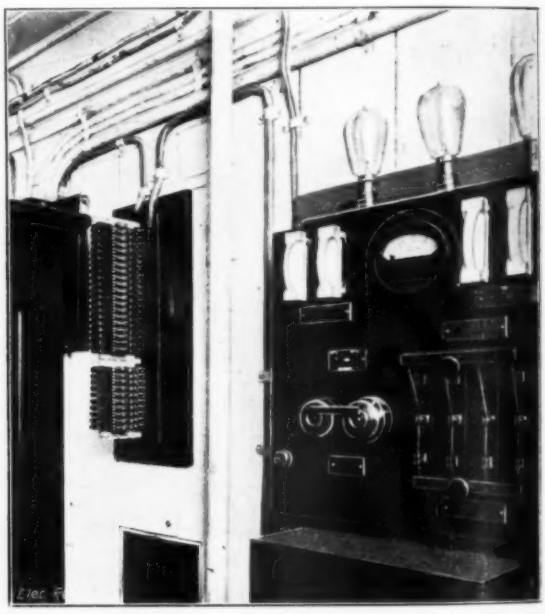


Fig. 3.—Test Frame and Power Board.

pattern, equipped with calling dials. Our first illustration shows H.M.S. *Dolphin* with a submarine of the "C" class alongside.

The switchboard is accommodated in a deck cabin 10 ft. 6 in. by 5 ft. by 7 ft. 4 in. high, the disposition of the apparatus and of the batteries (in the background) being shown in fig. 2. For the purpose of illustration the protecting covers have been removed from some of the switches, and the fume-proof cover of the batteries is not in evidence. The equipment operates at 12 volts, current being furnished by six K.L.G. type Chloride cells. The batteries are in duplicate, enabling one set to be held in reserve, or on charge, whilst the other is in service; each is of 14 Ah capacity, with a 3-amp. charging rate, lamps being used as resistances for regulating the current from the charging motor-generator.

Our third illustration shows the test frame, equipped with lightning arresters and protective devices, for testing the lines and equipment. Alongside is the associated power board.

Apropos of the projected facilities at docks and quaysides to enable ocean-going passengers to enjoy telephone facilities over the mainland service up to the time of sailing, or immediately after berthing, it is

noteworthy that the Strowger installation on H.M.S. *Dolphin* provides junction facilities with the manual exchange at Fort Blockhouse, where the ship is normally berthed when on home service. Two junction circuits serve to carry this traffic between the ship and shore, suitable clearing, or supervisory, signals being arranged on the shore exchange switchboard to indicate when a ship subscriber hangs up his receiver at the end of a conversation.

The method of calling on this ship installation is analogous to that on similar Strowger p.a.x. installations ashore. The telephones aboard H.M.S. *Dolphin* require no operator and ensure privacy; they will be used for inter-official communication between officers and crew.

Forthcoming Events.

National Association of Supervising Electricians.—Tuesday, April 21st. At St. Bride's Institute, E.C. At 7.15 p.m. Lecture on "Electric Lighting and Automatic Apparatus on Railways," by Mr. T. H. Windibank.

Institution of Production Engineers.—Wednesday, April 22nd. At the Engineers' Club, W. At 7.30 p.m. Paper on "Press Tool Work," by Mr. F. P. Turner.

Radio Society of Great Britain.—Wednesday, April 22nd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "Communication on Wave Lengths other than those in General Use," by Mr. G. G. Blake.

Institution of Electrical Engineers.—Thursday, April 23rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Recent Improvements in the Insulation of Electrical Machinery," by Lt.-Col. R. G. Maxwell and Mr. A. Monkhouse.

INFORMAL MEETING.—Monday, April 20th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Latter-day Wireless," to be opened by Mr. M. Hart.

(Scottish Centre).—Friday, April 24th. At the Technical Institute, Dundee. At 7 p.m. Discussion on "Justifiable Small Power Plant," to be opened by Mr. A. B. Mallinson.

(North-Midland Students' Section).—Tuesday, April 21st. At the Leeds University. At 7 p.m. Address by the chairman (Mr. T. B. Johnson) of the North-Midland Centre.

(Mersey and North Wales (Liverpool) Centre).—Monday, April 20th. At the University, Liverpool. At 7 p.m. Paper on "Electricity in Mines," by Major E. I. David.

Edinburgh Electrical Society.—Friday, April 24th. At the Philosophical Institution, 4, Queen Street. At 8 p.m. Paper on "Electricity Applied to Navigation," by Mr. R. W. J. Stark.

Birmingham Electric Club.—Friday, April 24th. At the Grand Hotel, Colmore Row. At 7 p.m. Lecture on "Electrification of Railways," by Mr. C. E. Fairburn.

Institution of Mechanical Engineers.—Friday, April 24th. At the Institution, Storey's Gate, S.W. At 6 p.m. General meeting—Reports to the Hardness Tests Research Committee.

Junior Institution of Engineers.—Friday, April 24th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "The Manufacture of Gramophone Records," by Mr. H. E. Cowley.

Physical Society of London.—Friday, April 24th. At the Imperial College of Science, S.W. Tenth Guthrie Lecture, by Prof. W. Wien, on "Recent Researches on Positive Rays."

Notes.

"Underground" Emergency Regulations.—In the official report issued by the Ministry of Transport of the inquiry into the circumstances of the collision on the London Electric Railway near Charing Cross on January 19th, 1925, the following recommendations are made:—In the event of an unmistakable collision in a Tube section—an extremely rare occurrence—the signal to remove the line pressure should be given at once whether any symptoms of fire or arcing are immediately apparent or not. The result is, of course, a considerable reduction in the train lighting, but this should, in the event of accident, rather reassure than alarm the public if they recognise that, so far from being a symptom of danger, it is an indication that any risk of fire or further collision is thereby obviated. The emergency train lighting is to be improved; at present it consists of two lamps, supplied from batteries in each car, which are brought into action automatically in the event of failure of the traction supply. The removal of the line pressure is effected by "short-circuiting" two "telephone" wires which run along the whole of the tunnel sections. This can be done by any of the train staff without leaving the train, by means of "telephone clips" kept for that purpose. The "shorting" of these wires throws out the traction breaker at the supply sub-station.

Appointments Vacant.—Assistant electrical engineer (Rs. 450 per month) for the Bombay, Baroda, and Central India Railway. Junior charge engineer for the Gloucester Corporation Electricity Department. General engineering assistant for the Aldershot Gas, Water, and District Lighting Co. (See our advertisement pages to-day.)

An Advisory Committee on Domestic Supplies and Methods of Charging.—The Electricity Commissioners, in pursuance of their powers under Section 4 of the Electricity (Supply) Act, 1919, have appointed the following gentlemen, namely, Messrs. J. W. Beauchamp (Chairman), S. T. Allen, and A. N. Rye, representing the British Electrical Development Association Incorporated; Messrs. J. S. Highfield and F. B. Woodhouse, representing the Incorporated Association of Electric Power Companies; Messrs. A. C. Cramb and W. C. P. Tapper, representing the Incorporated Municipal Electrical Association; and Messrs. H. Bentham, F. E. Gripper, and K. A. Scott-Moncrieff, representing the Provincial Electric Supply Committee of the United Kingdom, to be an Advisory Committee to consider and report upon the following questions:—

(1) What steps are being taken by authorised undertakers to encourage and extend the use of electricity for domestic purposes; the relative effectiveness of such steps; and what further steps could be taken by authorised undertakers in general to bring about an increased consumption of electricity for the purposes in question.

(2) What methods of charging for domestic supplies could be authorised as standard methods (subject to the fixing of an appropriate quantum in individual cases) for adoption at the option of authorised undertakers in lieu of charging by the actual amount of energy supplied or by the electrical quantity contained in the supply.

(3) What legislative powers, if any, beyond those already conferred by the Electricity (Supply) Acts would be necessary to give effect to any recommendations made in respect of questions (1) and (2).

The Commissioners have appointed Mr. C. E. Allan to be Secretary to the Committee.

A Grave Loss to "Electro-farming."—All who are interested in the application of electricity to agriculture are acquainted with the excellent work that has been done by our valued contributor, Mr. R. Borlase Matthews, to promote its development, not only by carrying on full-scale experiments and practising the art on his own farm, but also by collecting and classifying a great mass of data bearing on the subject, including records of actual operating costs, &c. We regret to learn from Mr. Matthews that this fine collection, probably unique in scope and wealth of detail, has been destroyed through the burning of his office on Good Friday. Fortunately the fire was prevented from extending to other buildings. Much of the material will be exceedingly difficult to replace; Mr. Matthews, however, is not discouraged, and intends to build up again a collection which shall be a replica, at least in miniature, of the library that he has lost. He will be glad to receive from firms and individuals copies of their catalogues, pamphlets, &c., for this purpose, at Greater Felcourt, East Grinstead.

Success of Electrical Dock Plant.—At a recent meeting of the Clyde Navigation Trust, the Workshops Committee reported that the consulting electrical engineers for the new electrically-driven plant at Prince's Dock and the Graving Docks had stated that the total capital expenditure was £61,800, and that the annual saving in running costs effected last year, as compared with those in 1920 (the last year of the old plant), amounted to £14,505, or 23.47 per cent. on the new capital, subject to interest and depreciation charges.

Edinburgh Infirmary Radiology Department.—The radiological department of the Edinburgh Royal Infirmary, the plans for which have been passed at the Edinburgh Dean of Guild Court, is expected to be the largest and most completely equipped in this country, says the *British Journal of Radiology*. It is hoped that it will be in working order by October, 1925, and the electrical and other equipment will necessitate an expenditure of £12,000. The ground floor will be arranged for radiography, with a screening room specially designed for following up opaque meals through the stomach and intestines; another screening room for heart and lung cases; developing rooms and rooms for superficial X-ray treatment. The deep therapy room will be used chiefly for the treatment of cancer, and it is intended that the apparatus to be installed for this purpose shall have great power and work at a voltage of 250,000. On the ground floor there will be a demonstration room for students, capable of seating 100, and a smaller room, capable of holding twenty to thirty students, also a laboratory for research work, administrative rooms, and waiting and dressing rooms. On the upper floor there will be rooms for massage, remedial exercises, and treatment by electrical applications, radium and artificial sunlight, as well as photographic and developing rooms. A very complete system of artificial ventilation by mechanical suction will be installed.

International Congress of Radiology.—The above congress which is to be held from July 1st to 4th in London, will be preceded by a reception at the Royal Society of Medicine on the evening of June 30th. The Silvanus-Thompson memorial lecture will be delivered by the Duc de Broglie (Paris), on the evening of July 1st; the subject (in physics) will be announced later. The Mackenzie-Davidson memorial lecture will be delivered by Sir Berkeley Moynihan (Leeds), on the evening of July 3rd; subject, "The relationship of Radiology and Surgery." An official dinner will be held on July 2nd. The Congress will meet in three sections: (1) Radiology; (2) electrotherapy and physiotherapy; and (3) physics, and a selection of negatives and prints will be exhibited in the British Institute of Radiology. An exhibition of radiological, electro-medical, physical and other apparatus, also of books and other objects of interest, will be held in the Central Hall, Westminster, and all the sections will meet in the same building.

Faraday House Concert.—Faraday House Old Students' Association reminds us that the annual smoking concert will be held at the Hotel Cecil (Princes Hall) on May 1st, at 8 p.m., with the president, Mr. H. W. H. Richards, M.I.E.E., in the chair. Accommodation will be available for 300, and an excellent concert has been arranged.

Communication with Mains-men.—At a recent meeting of the Peterborough Electricity Committee the manager stated that experiments had been carried out by Mr. Rowland and Mr. Berridge, of his department, with a view to the use of portable wireless apparatus for communicating with gangs of men working at distant places, and that such experiments gave very promising results. Permission had been given by the Postmaster-General for the issue of a licence the cost of which would be £3 for the first year and £2 per annum thereafter, and he asked whether the Committee would consent to pay the licence fees. He gave instances of the value which such apparatus would have when properly developed. It was unanimously resolved that the Council be recommended to pay the licence fees due to the Postmaster-General.

Summer Time.—At 2 a.m. (G.m.t.) on Sunday morning, April 19th, "summer time" will commence in this country. In New York it will be introduced on April 27th, and it started in France and Belgium on April 5th.

Diesel-Electric Locomotive Tests.—According to *The Railway Gazette*, some Diesel-electric locomotives of an entirely new type were recently delivered to the Russian Government. They were subjected to tests before being dispatched, and the results show an exceptionally low consumption of fuel oil. The trials were conducted by means of a test plant, each test being of about one hour's duration. The average drawbar pull was 20,060 lb., and the average output 857 h.p. The oil consumption was 0.507 lb. per h.p.-hr., 42 per cent. less than the 0.88 lb. stipulated in the contract between the Russian Government and the builders. The average total efficiency was calculated and found to be 27.4 per cent., a result which, it is stated, has never been reached before. The load varied from 820 h.p. to 880 h.p., or by about 6 per cent., and the fan on the cooling tender was not in operation during some of the tests, as the cooling apparatus on the locomotive was found to be sufficient. The cooling water in this apparatus reached a temperature of 117.5 deg. F., with an air temperature of 51.8 deg. F.

In another test the average drawbar pull was 9.534 lb., and the average capacity 474 h.p., the oil consumption per h.p.-hr. averaging 0.522 lb., or 41 per cent. less than stipulated. The total efficiency in this case was 26.5 per cent. The load varied from 440 h.p. to 490 h.p., or about 9.5 per cent.

During another test the fans of the cooling tender were in operation throughout, decreasing the water temperature from 150.8 deg. F. to 134.6 deg. F. The total efficiency was 24 per cent., at a speed of 14.54 miles per hour.

Radio on Aircraft.—The R 33 made a long and successful flight last week of over 800 miles, during which time she cruised all along the East Coast from Norfolk, flew over London, and then cruised for eight and a half hours above fog banks waiting for the mists to clear. A notable feature of the flight was that, owing to the sudden fog, Major Scott, for 8½ hours of the time spent in the air, navigated the ship entirely on wireless bearings picked up from the direction-finding stations at Pulham and Croydon, says *The Times*.

Hydro-Electric Development in Canada.—Some interesting figures as to hydro-electric development in Canada during 1924 are given in *Engineers and Engineering*, as the result of a review by the Dominion Water Power and Reclamation Service of the Department of the Interior, Canada. More than 300,000 h.p. was added during the year, bringing the total installation in the Dominion up to 3,569,275 h.p. Many large projects were also advanced to such a state that this figure will be increased by more than 600,000 h.p. during 1925. The City of Winnipeg has ordered three additional sets of 3,700 h.p. capacity each. In connection with the City's hydro-electric enterprise, a steam stand-by plant in combination with a central steam heating and distribution system was completed and put into operation in October. The stand-by plant, which cost $1,250,000, and has a capacity of 11,000 kW, is designed to provide for interruptions which may occur in the hydro-electric supply from the Winnipeg river, while its boilers in conjunction with two 7,500-kVA electric steam generators, using surplus or off-peak hydro power, provide steam for the heating of the central business portion of the city. In Ontario the installations were increased by 132,000 h.p. On the Niagara river at the Queenston station, two additional 55,000-h.p. units were installed, and it is expected that two more similar units will be installed during 1925, making a total of 550,000 h.p. in the station. In Quebec the installations were increased by 175,000 h.p.

Severn Power Scheme. — A conference convened by the Electricity Commissioners has been held at Bristol to consider the general question of electricity supply in the Lower Severn district. The conference appointed a committee of electrical engineers to consider the matter and the establishment of a suitable power station.

The Electrical Equipment of Motor Vehicles.—The Royal Automobile Club has issued an interesting analysis of the causes of failure in motor-cars during the past year in connection with its "Get You Home" scheme. Assistance was given during the twelve months to a total of 5,039 cars, and it is interesting to note that the failures as regards electric lighting installations were only responsible for 2.2 per cent. of the total breakdowns, and engine starters for but 0.8 per cent. On the other hand, ignition was responsible for 20.7 per cent., as against only 18.4 per cent. in 1923.

Educational.—Faraday House Scholarships.—As a result of the entrance examination held at Faraday House Electrical Engineering College on the 7th, 8th, and 9th of April, the following awards have been made:—R. J. Hiller, the "Faraday" scholarship; M. S. Hawker, the "Maxwell" scholarship; R. P. Horlock, E. J. R. Kay, and R. B. Barton, exhibitions, and J. E. W. Ginger, an entrance prize.

Single-core Armoured Cables.—A paper on the use of single-core armoured cables for a.c. is to appear in the I.E.E. *Journal* as a corollary to that of Prof. Cramp and Miss Calderwood; it deals with the losses involved in the distribution of alternating currents in sheathed cables in which the sheath is of magnetic material. Single-core rubber-insulated cables, each enclosed in a separate iron tube, and also single-core cables armoured with one or two layers of galvanised iron or steel wires, are dealt with, and experimental data are given showing the measured losses in each case. The authors of the paper, Messrs. G. M. Harvey and A. H. W. Busby, show that, while the losses due to induction in a tube are considerable, those in a wire-armoured cable are comparatively very small, and also that the distance separating the individual cables forming a circuit has very little effect in determining the losses involved. In the case of the wire-armoured cable, also, the connection of the sheaths of separate cables so as to form a closed sheath circuit has no appreciable effect upon the losses, and the current which will flow in such a circuit is so small as to produce no considerable heating.

Blind Telephone Operators.—Although it has already been stated in these pages, it may not be generally known that one of the most successful occupations taught to the blinded soldiers at St. Dunstan's is telephone operating. A large number of these men have found employment with important business firms and organisations in London and the provinces, and the freedom from outward distraction—a natural accompaniment of blindness—enables the blind operator to concentrate on his work to a much higher degree than is possible for a sighted operator, and thus he can maintain an excellent service. St. Dunstan's has several fully-trained men ready for work, and should any readers like to give one of the operators a trial, St. Dunstan's headquarters (Inner Circle, Regent's Park, London, N.W.1) will supply full particulars. A point to bear in mind is that the employer's liability for his blinded soldier operator is no more than for an ordinary employé. To his employer he is a perfectly normal member of the staff. His special needs as a blinded ex-Service man are the permanent and sole responsibility of St. Dunstan's After-Care Organisation.

Varnish Spraying for Motor Windings.—According to the *Electric Railway Journal*, the Department of Street Railways for the city of Detroit, Mich., has adopted the practice of coating the inside of motor frames and the field coils with insulating varnish after the coils have been assembled. The varnish is applied with a home-made spraying gun which has two flexible connections, one for the air supply and the other for the varnish supply, both of which are controlled by the operator by means of valves arranged conveniently in the connections. The varnish is sprayed around the field coils and over those parts of the frame where flash-overs are likely to occur.

The Great Lake Diversion.—The *Electrical News* (Toronto) reports that Mr. Weeks, the United States Secretary for War, has given a decision in the recent dispute regarding the diversion of the waters of Lake Michigan by the Chicago municipality for sanitary purposes. This decision permits the city to divert a maximum of 11,000 cu. ft. per second until the end of 1929 and, according to our contemporary, one clause of the ruling merely suggests that at the end of the period such sewage disposal works shall be built as will reduce the diversion to 7,500 cu. ft. per second. It is claimed that Canadian interests (navigational and hydro-electric) have been entirely ignored in the decision. The opposition to the diversion was not solely Canadian; the States on the Great Lakes also considered that their interests were adversely affected.

The Grenoble Exhibition.—The International Exhibition of Hydraulic Power at Grenoble will be opened officially on Thursday, May 21st. Most European countries are taking an important part in this exhibition, particularly in the Water Turbine Section and in the various electrical sections.

The Shannon Hydro-Electric Scheme.—Our Dublin correspondent writes that while the controversy regarding the Shannon hydro-electric scheme is still in full vigour, much criticism being directed against the Government's acceptance of the experts' report on the German proposals, Mr. McGilligan, Minister of Industry and Commerce, has decided, on the basis of the authorising resolution passed by the Dail, to proceed at once to legislative action. This will take the form of three separate measures. The first has already been prepared by the Minister, and will probably be introduced in the Dail on April 22nd. It is said that this Bill is not of a very comprehensive character. A leading provision empowers the Government to direct the course of the Shannon in whatever manner it may think fit for the purpose of the Siemens-Schuckert proposals, the scope of which has been already explained in our pages. Power is given to the Minister to acquire land compulsorily, and a special clause deals at large with the question of compensation. The effect of the Bill, it has been ascertained, is to commit the State to the huge undertaking. That it will have a smooth passage goes without saying, in view of the fact that no division was called for on the authorising resolution. Some slight opposition may

be expected from the meagre group of Independent deputies, but the Farmers' Party, which at first objected on the ground of undue haste, is now understood to be ready to support the Government plans.

As for the second Bill, it will not probably be passed for several months after the first, but it will be pressed forward before the end of this year. According to reliable authority, it will deal with organisation, providing for the setting-up of a Board of Control, thus enabling the country to realise to what extent Government control will be exercised. It is interesting at this point to recall that the Board of Public Works, under the direction of the Ministry of Industry and Commerce, works out the details of hydraulic affairs of State importance, but research effort has hitherto been left to individuals.

Before the adjournment of the Free State Senate for Easter, Sir John Keane called attention to the Government's refusal to publish the plans of the Shannon scheme, and also the schedule of prices upon which the estimate was based. In the absence of these, he said, it was impossible to judge whether the proposals were sound. In reply Mr. McGilligan said that if Sir John's remarks meant that the banks and financial houses would make a stand with regard to the financing of the scheme, it should be pointed out that the banks merely held money as the trustees of the owners. He did not expect to have any trouble with the banks, but if trouble did arise the Government would be in a position to meet it. On the demand for publication of plans and the schedule of prices, he held that such publication at present would be unreasonable; but he gave an assurance that the Government was completely safeguarded, and that, while Messrs. Siemens-Schuckert could not claim more than the prices in the schedule, they could be compelled to take less if any other firm could do any part of the work for a lower figure. Sir John Keane said he could not understand how the estimates were binding when provision had been made for variations and change of quantities. Mr. McGilligan observed that the experts' report contained a definite statement that where variations took place in quantities, the variations in prices would not be more than 10 per cent. up or down. The unit prices for these quantities were fixed, and 10 per cent. was the most they could be varied by.

Electricity in Belgian Collieries.—Good progress is being made with the development of the collieries of the Société des Charbonnages de Helchteren et Zolden. Work is well in hand in connection with the sinking and equipment of two new shafts, the winding and other gear of which will be electrically operated. The energy will be supplied from the company's own generating station, at which the first 3,000-kW turbo-alternator is now being installed, a second set of 6,000 kW capacity being also in course of construction.

Institution Notes.

Royal Institution.—The Tyndall Lectures will be delivered by Professor Whiddington on "The Passage of Electricity through Vacuum Tubes," commencing on Tuesday, May 19th.

Iron and Steel Institute.—The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, May 7th and 8th, 1925. The outstanding events of the meeting will be the election of the new council, the presidential address of the new president, Sir Frederick Mills, Bart., the annual dinner of the Institute at the Hotel Cecil, Strand, W.C., on Thursday, May 7th, at 7 for 7.30 p.m., under the presidency of Sir Frederick, and the announcement of the award of the Andrew Carnegie Research Scholarships for 1925-6. Applications for tickets for the dinner, price 15s., may be made not later than April 30th.

The autumn meeting of the Institute will be held in Birmingham on September 9th, 10th, and 11th. A provisional programme of arrangements which has been drawn up includes a reception by the Lord Mayor of Birmingham and numerous works visits in Birmingham.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The *Yorkshire Observer* says that Mr. T. ROLES, the Bradford City Electrical Engineer, who recently underwent a serious operation at the Ilkley Hospital, has now so far recovered that he has been able to leave that institution. His recovery is proceeding satisfactorily.

SIR ERNEST CLARKE, who was until recently Permanent Secretary of the Ministry of Finance of the Northern Ireland administration, has taken up a position with the Underground Railways Co. of London, Ltd.

Mr. W. CHAMBERLAIN, general manager and engineer of the Oldham Corporation Tramways, has been appointed general manager of the Leeds Corporation Tramways at a salary of £1,500 a year.

The York City Council has increased the salary of the electrical engineer by two annual increments of £50; that of the electrical superintendent by £40 in two annual increments; and that of the installation superintendent by £25.

Mr. A. R. BURROWS, Director of Programmes with the B.B.C., has relinquished that appointment in order to become manager of an international broadcasting bureau, which is to be set up at Geneva. Mr. C. A. LEWIS will carry on the duties for which Mr. Burrows has hitherto been responsible. These matters were arranged at the Conference of European Broadcasting Organisations held in London.

It is reported in the *Electrical Engineer of Australia and New Zealand* that Mr. A. MAUGHAN, general manager of the Australian General Electric Co., Ltd., left Sydney in January on an eight months' trip to England, America, and the Continent; also that Mr. D. G. POYITT, assistant engineer in the Sydney Electricity Supply Department, has been nominated by Mr. H. R. Forbes Mackay, the general manger, as Safety Officer to suggest schemes for accident reduction and to collect and tabulate data as to causes of accidents and illness.

Mr. ALAN WRIGHT, who for 23 years has been an employé of the Bradford Corporation Tramways, has been presented with a smoking cabinet on the occasion of his retirement.

The Bury (Lancs.) Town Council has increased the salary of the electrical engineer from £750 to £850 per annum.

Mr. W. J. CANADA is relinquishing charge of the Engineering Department of the National Electric Light Association (U.S.A.) to undertake the recently-established position of "electrical field secretary" with the National Fire Protection Association.

The Finance Committee of the Perth Town Council has deferred consideration of applications for increases of salary made by the electrical engineer and the gas manager until the salaries paid in other towns have been ascertained.

Stretford Urban District Council Electricity Committee has re-appointed Mr. J. A. ROBERTSON as consulting electrical engineer for 1925.

The Chesterfield Corporation Salaries Committee has granted Mr. D. H. DAVIES, electrical engineer, an honorarium of £50 for his services as electrical engineer and tramway manager pending the appointment of a tramway manager.

Mr. JAMES HATTON, A.M.I.Mech.E., has been appointed to the board of Sutcliffe Bros. & Bryce, Ltd., of Hyde. He will take charge of the company's cold storage insulation department.

The Post Office Electrical Engineers' Journal states that Mr. E. H. SHAUGHNESSY, O.B.E., M.I.E.E., has been appointed to the newly-created post of Assistant Engineer-in-Chief in charge of Wireless Services.

Obituary.—MAJOR R. V. MORSE.—According to the *Electrical Engineer of Australia and New Zealand*, Major Richard Victor Morse, D.S.O., chief assistant electrical engineer in the New South Wales Public Works Department, died on January 26th.

MR. J. A. E. RAYNER.—*The Times* reports the death, on April 7th, of Mr. J. A. E. Rayner, managing director of the United Alkali Company. Mr. Rayner was the nephew of Andrew Kurtz, the founder of the chemical works of that name in St. Helens. He became a member of that firm at an early age and when the United Alkali Co. was formed in 1890 he was in control of the Kurtz business. He became a director of the new company and shortly afterwards was appointed managing director.

MR. C. F. TUBBS.—We regret to learn of the death of Mr. C. Franklin Tubbs, of the Igranic Electric Co., Ltd., as the result of a motor-cycle accident on April 4th. Mr. Tubbs commenced his career with Messrs. Crompton & Co., Ltd., ultimately having charge of the designing, manufacturing, and testing of arc lamps. He was then for 15 years in business on his own account as an electrical engineer. He joined the Igranic Electric Co., Ltd., in May last year.

DR. CARL HEIM.—The death is announced from Jugenheim, Germany, at the age of 67 years, of Prof. Dr. Carl Heim, who was well known for his work in connection with telegraphy, telephony, electrical measurement, and electro-metallurgy.

MR. A. CHADWICK.—The death occurred on April 3rd, as the result of an accident, of Mr. Arthur Chadwick, electrical engineer, of Wilmslow, Cheshire.

MR. H. C. KITCHER.—The death is announced, at the age of 75 years, of Mr. Henry Charles Kitcher, who had for 25 years been in business as an electrician at Bournemouth.

MR. E. B. ELLICE-CLARK.—We regret to record that Mr. Edward Badouin Ellice-Clark, M.Inst.C.E., passed away on April 6th at Mentone, of acute blood poisoning after a few days' illness. Mr. Ellice-Clark was for many years prominently associated with the Edison & Swan Electric Co., Ltd., and until his death was on the board of its subsidiary concern, the Altrincham Electric Supply, Ltd., and he was a director of the Amazon Telegraph Co., Ltd. The deceased gentleman was in his 78th year.

New Companies Registered.

Mica Products, Ltd. (13,603).—Private company. Registered in Edinburgh April 7th. Capital, £2,500 in £1 shares (2,200 preference and 300 ordinary). Objects: To carry on any of the businesses of miners, importers and preparers for market of mica, mica-schist, talc, &c., manufacturers, brokers, merchants and agents. The subscribers (each with one share) are:—J. A. Matthew, 6, The Drive, Orpington, Kent, electrical engineer; D. Allan, 12, Henrietta Street, London, W.C.2, electrical engineer. The first directors are not named. Qualification, one ordinary share. Remuneration, not exceeding £200 per annum. Secretary: David Lindsay Allan.

Hadden & Pearce, Ltd. (205,138).—Private company. Registered April 8th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electric light fittings and electric, magnetic, galvanic and other apparatus, electrical engineers and contractors, &c. The directors are:—E. Pearce, 13, Mitcham Lane, Streatham, S.W.16; J. Hadden, Larnswood, Clairview Road, Streatham Park, S.W.; E. R. Pearce, 62, Ravensbury Road, S.W.18. Qualification (except original directors), 500 shares. Remuneration, £5 each per annum. Solicitors: Finch, Turner & Taylor, 84, Cannon Street, E.C.4. Registered office: 24, Grosvenor Place, Victoria Street, S.W.1.

Knivetown Electric Wire Co., Ltd. (205,184). — Private company. Registered April 9th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers, manufacturers of wireless cables and other apparatus connected with wireless telegraphy, and to acquire trade mark No. 452,243, &c. The life directors are:—F. Kniveton, 168, Brook House Road, Bellingham, Kent; H. Kniveton, 168, Brook House Road, Bellingham, Kent. Solicitor: J. Deans, 1, Charing Cross, S.W.1. Registered office: 86, Rosebery Avenue, Clerkenwell, E.C.

Lancashire Telephone Systems, Ltd. (205,196).—Private company. Registered April 9th. Capital, £3,000 in £1 shares. Objects: To carry on the business of installing and erecting automatic and other telephone systems, &c. The permanent directors are:—A. H. Kay, 27, King Street West, Manchester; C. S. Ashworth, "The Homestead," Poynton, Cheshire. Qualification, 250 shares. Remuneration as fixed by the company.

T. and H. Joyce, Ltd. (205,213).—Private company. Registered April 9th. Capital, £300 in 1s. shares. To carry on the business of manufacturers, builders, designers, repairers and owners of electrical and engineering machinery, engineers' machinists, smiths, electricians, &c. The directors are:—T. H. Joyce, 85, Ladbroke Grove, W.11 (director of Contract Engineering Co., Ltd.); Annie A. Joyce, 85, Ladbroke Grove, W.11. T. H. Joyce is permanent. Solicitor: Warden Gowing, 4, Sackville Street, W.1. Registered office: 210b, Shaftesbury Avenue, W.C.2.

British General Trading Co., Ltd. (205,128). — Private company. Registered April 7th. Capital, £1,200 in 1,000 preference shares of £1 and 4,000 ordinary of 1s. Objects: To manufacture under licence an invention for the prevention of oscillation in the receipt of wireless communications, and securing and giving louder and clearer signals and improvement in the clearness in receiving messages and signals in respect of wireless communications, with power to carry on the business of electrical engineers, manufacturers of and dealers in electrical apparatus, &c. The first directors are:—E. A. Burton, 8, Ramsey Street, Bethnal Green, E.2, cabinet maker; P. R. Blythe, 81, Warrington Crescent, Maida Vale, W., finance broker. Registered office: 160, Victoria Street, S.W.1.

Forest City Electric Co., Ltd. (205,082).—Private company. Registered April 6th. Capital, £5,000 in £1 shares. Objects: To adopt an agreement with S. T. Quilliam, and to carry on the business of manufacturing engineers, manufacturers, importers and exporters of, and dealers in machinery, apparatus, instruments, equipment, contrivances, materials and accessories for tramways, railways, motor vehicles, light and power stations, ships and general engineering, and of any other engineering or electrical machinery, plant and goods of all kinds, &c. The subscribers (each with one share) are:—S. T. Quilliam, 67, Queen's Road, Urmston, near Manchester, electrical engineer; W. F. Quilliam, 67, Queen's Road, Urmston, near Manchester, accountant's clerk. S. T. Quilliam is first and permanent governing director. Qualification, 100 shares. Solicitors: Fredk. W. Ogden, Lyles & Co., 11, Blackfriars Street, Manchester.

The British Institute of Philosophical Studies (205,010).—Registered on April 6th as a company limited by guarantee, without share capital. The company is not formed for purpose of profit, and the word "limited" is omitted from the title by licence of the Board of Trade. The objects are:—To carry on business as indicated by the title. The first members of the Council are:—Emile Garcke, M.I.E.E., Ditton House, near Maidenhead, president of British Electrical Federation; S. E. Hooper, M.A., Cookham Dean, Bucks.; L. T. Hobhouse, M.A., D.Litt., LL.D., 15, Berkeley Place, Wimbledon, S.W.1.; Martin White, Professor of Sociology in the University of London; Viscountess Rhondda, 15, Chelsea Court, S.W.3; W. L. Hichens, 3, Central Buildings, S.W.1, chairman, Cammell Laird & Co., Ltd.; Sir Lynden Macassey, K.B.E., K.C., M.A., LL.D., D.Sc., 24, Sloane Gardens, S.W.1, president of Institute of Transport; S. Alexander, M.A., F.B.A., 24, Brunswick Road, Withington, Manchester, late Professor of Philosophy at Manchester University. Solicitor: S. Morse, Alder House, Aldersgate Street, E.C.1.

Vee-Gee Dry Cell Co., Ltd. (205,244).—Private company. Registered April 11th. Capital, £5,000 in £1 shares. Objects:—To adopt an agreement with R. Porrill with a view to the manufacture, purchase or sale of electric dry cell batteries and apparatus and machinery therefor, &c. The permanent directors are:—H. B. Vale, 16, Market Place, Reading; E. W. Reeves, "Samarkand," Wokingham. Qualification, 100 shares. Solicitors: Pitman & Bazett, Newbury.

Official Returns of Electrical Companies.

Wireless Warehouses, Ltd. — Particulars filed of £3,000 debentures authorised March 4th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Also registered second debenture dated March 16th, 1925, to secure all moneys remaining unpaid in respect of goods sold to the company to an amount not exceeding £5,000, charged on the above property (subject to £3,000 first mortgage debentures). Holders: Albert Lee & Co. (1923), Ltd., 8 and 9, New Zealand Avenue, E.C.

Thompson Manufacturing Co., Ltd.—Mortgage debenture dated March 12th, 1925, to secure £500 charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: A. U. B. Ryall, Lonsdale House, Carlyle Road, Ealing.

Ledion, Ltd.—Particulars filed of £200 debentures authorised March 19th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £150.

United Weldings and Electrical Co., Ltd.—Particulars filed of £5,000 debentures authorised March 25th, 1925, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,435.

Coates & Co. (Sheffield), Ltd.—W. B. Powers, C.A., of 17, Bank Street, Sheffield, ceased to act as receiver or manager on behalf of the second debenture holders on April 6th, 1925.

Hamilton Bros., Ltd. — H. Lever, C.A., of Chiswell House, Finsbury Pavement, E.C., was appointed receiver and manager on March 23rd under powers contained in floating charge dated January 27th, 1925.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £1,880 on March 31st, 1925, of perpetual first mortgage debenture stock covered by trust deed dated December 16th, 1897, securing £200,000.

Thompson Manufacturing Co., Ltd.—Satisfaction in full on March 25th, 1925, of debenture dated March 10th, 1924, securing £175.

J. Carter, Sons & Co., Ltd.—Satisfaction in full on March 16th, 1925, of mortgage dated December 31st, 1923, securing all moneys due or to become due.

Barbados Electric Supply Corporation, Ltd. (104,867).—Return dated January 13th, 1925. Capital, £60,000 in 40,000 preferred and participating and 20,000 ordinary shares of £1 each. 35,173 preferred and 20,000 ordinary shares taken up. £34,672 paid on 34,672 preferred shares. £20,500 considered as paid on 500 preferred and 20,000 ordinary shares. Mortgages and charges, £19,000.

Lamp Manufacturing Co., Ltd. (76,151).—Return dated February 9th, 1925. Capital, £10,000 in £1 shares. 5,400 shares taken up. £5,400 paid. Mortgages and charges, £2,500 debentures.

Hampshire Light Railways (Electric) Co., Ltd. (52,564).—Return dated December 31st, 1924 (filed April 1st 1925). Capital, £1,000 in £10 shares. All shares taken up. £1,000 paid. Mortgages and charges, nil

I. T. C., Ltd. (99,612).—Return dated December 25th, 1924. Capital, £20,000 in £1 shares. 15,000 shares taken up. £15,000 paid. Mortgages and charges, nil.

W. E. Dove & Co., Ltd. (72,630).—Return dated March 9th, 1925. Capital, £3,500 in £10 shares. 320 shares taken up. £2,000 paid. £1,200 considered as paid. Mortgages and charges, £800.

Northampton Electric Light and Power Co., Ltd. (28,640).—Return dated March 3rd, 1925. Capital, £350,000 in 10 "A" and 349,990 "B" shares of £1 each. 10 "A" and 349 123 "B" shares taken up. £349,133 paid. Mortgages and charges, £200,000.

Wrexham and District Transport Co., Ltd. (formerly Wrexham and District Electric Tramways, Ltd.).—Satisfaction in full on January 5th, 1920, of debenture dated December 14th, 1906, securing £4,500. (Notice filed, April 6th, 1925.)

City of Buenos Ayres Tramways Co. (1904), Ltd. (82,214).—Return dated March 2nd, 1925. Capital, £1,240,000 in £5 shares. All shares taken up. £1,240,000 considered as paid. Mortgages and charges, £174,000.

Smithfield Markets Electric Supply Co., Ltd. (53,354).—Return dated March 13th, 1925. Capital, £100,000 in 60,000 shares of £1 each and 8,000 shares of £5 each. 60,000 £1 shares taken up. £60,000 paid. Mortgages and charges, £16,670.

City Notes.

Metropolitan-Vickers Electrical Co., Ltd.

The annual meeting was held on April 7th. Major-Gen. Sir Philip Nash, K.C.M.G., who presided, in moving the adoption of the report (*vide* Elec. Rev., April 3rd, p. 546), said that the result of the year's working was a balance of £269,523, as against £229,215 last year, an increase of £40,308. It was proposed to add £25,000 to the general reserve, to pay dividends of 8 per cent. on the preference and ordinary shares and to carry forward £92,385. The year 1924 had produced a record output from the works, even including the war years, when a large tonnage of munitions of war was shipped. Orders receiving during 1924 were in value about 30 per cent. greater than those received in 1923, while the orders completed were in value about 21 per cent. greater. The tonnage of orders completed represented an increase of about 23 per cent. over 1923. Prices still remained at a lower level owing, no doubt, largely to the depressed condition of trading generally and the continuance of severe competition in the industry itself. With regard to export business, the volume for the year 1924 showed an increase of 43.8 per cent. over 1923. The prices obtained in the export markets carried, unfortunately, the barest margin of profit, but export work was nevertheless absolutely essential to the welfare of the company, and they intended to use every effort to develop the business abroad. They had obtained orders during 1924 from Norway, Russia, Holland, Rumania, Belgium, Spain, Persia, Burma, Palestine, China, Japan, India, Australia, New Zealand, South Africa, Brazil, the Argentine, and Chile, a list which would indicate the widespread activities of their export organisation. Perhaps the most satisfactory feature of their export position was the increased business which they were doing within the British Empire. As examples, he would refer specially to two large export orders obtained during the year; the first was the contract with the New South Wales Government for equipment in connection with the electrification of the city and suburban lines in and around Sydney. In that case they were faced with competition from all the large makers of heavy traction apparatus in the world, and it was a matter for great gratification that they had been able again to meet that competition successfully as they did in South Africa previously. The other contract was one entered into with the Victoria Falls and Transvaal Power Company for the complete transformer and switching equipment required for the company's new main power station at Witbank. That included high-voltage transformers and switchgear up to and including 135,000-V apparatus, and constituted, he believed, the largest and most important order for high-voltage apparatus ever placed in Great Britain. A study of the situation at home indicated that the possibilities of railway electrification on a much increased scale and of high-voltage long-distance transmission of power

in Great Britain were coming within the range of practical politics, and the experience which they had accumulated in both those important branches of the industry would place them in a premier position to take their full share in such developments here when they matured. At the present moment about 50 per cent. of the work passing through the company's works was for export, and in future he foresaw more than half their employés being occupied in export work. The difficulty in obtaining export work was not getting any less, and world competition was as severe as ever it was, and might get worse. Unless, therefore, they could keep down the cost of their products (and in the case of electrical apparatus the proportion of labour costs to the whole was necessarily very high), the present large volume of export work must grow less, and they would not be able to employ the same number of workpeople. Referring to the progress of the supply section of the business, the chairman said that in order to better extend the activities of that important branch, they had formed a separate company, Metro-Vick Supplies, Ltd. In this way they had placed themselves in a position to take full advantage of the increasing application of electricity to lighting, heating, cooking, and other domestic uses, apart from heavy power plant. There was a lack of co-operation in this country between the manufacturers and the electricity supply authorities. In this respect the United States of America was far ahead of us, and even in this country the British Commercial Gas Association had set an example which the electrical industry might well follow. The subject was one which merited the attention of the supply companies and municipalities, the manufacturers, and the professional side of the industry.

Dealing with the future prospects of the industry, Sir Philip said that in view of the considerable increase in the use of electricity in this country during and since the war, it might be assumed that the condition of the industry in so far as Great Britain was concerned was satisfactory, but an examination of the latest complete figures of output of electricity in this country, as compared with other countries, disclosed a very different position. If they took a further index of comparative development, *viz.*, the financial, they found that the capital invested per head of population in the U.S.A. in 1923 was £9 5s., in Canada £17, in Switzerland £10 5s., and in Great Britain about £4 15s. During the past year there had been a marked increase in the amount of attention to the subject of national development of electricity supply in our country, and it was satisfactory to note that it had entered into the political sphere. The Government was appreciating the vital part that a cheap and abundant supply of electric energy could play in our national industries, and a special committee was at present sitting to advise the Government on that important question. There was no country which needed electrical development more than our own as one of the means of reducing the cost of production in our industries, and as an important factor to help us to compete successfully in foreign markets. The average price obtained for current in Great Britain to-day was about 12 per cent. more than the average pre-war price. The density of our population, the well-defined concentration of our industrial areas, and the comparatively short distances involved in transmission of power in this country were features which all lent themselves to electrical development. He thought, therefore, that such statements as they now frequently saw to the effect that we were entering a period of great electrical development in this country could not be visionary. Again, to obtain lower costs it was essential that labour and capital should co-operate, as without such co-operation the industry could not succeed. The time was past for a policy of secrecy, and there was no necessity for it. In the past there had been a tendency for little disputes to grow into big issues, and he would like to feel that in future there would be in the early stages of disagreement frank and open discussion between workmen and employers. The electrical industry was to-day a "key" industry, as it could do so much for the good of other industries, and for the welfare of our people as a whole. Its development would not only help us here at home, but it would play an essential part in increasing the growth and the prosperity of the British Empire.

British Electric Transformer Co., Ltd.

The annual meeting was held on April 7th under the presidency of Mr. A. F. Berry. In proposing the adoption of the report (*vide* Elec. Rev., April 3rd, p. 546), the chairman said that the end of the year under review found them with orders in hand some 50 per cent. greater in value than those with which they started it, and the prices at which those orders were booked showed an improvement. With regard to the prospects for the current year, he believed that those who were engaged in the electrical manufacturing industry were well on the right road for providing employment for their people and profit of a modest order for their shareholders. The figures of their company for the past two years showed a steady improvement such as was anticipated when considering their position during the depths of the slump, but that steady improvement would have to be maintained for some time yet before they could feel satisfied. Competition to-day was not so much national as international, and in order to obtain sufficient work to find employment for their shops they had to accept prices, particularly for work in competition with other countries, which still did not leave a fair and sufficient margin. The planning and scheming, and rapid execution of orders could only be carried out with a minimum of expenditure of energy and internal friction when the minds of those engaged upon the work in hand were free from turmoil and unrest. They knew how comparatively meagre were the earnings of the staff by comparison with those who worked in sheltered industries. Very large numbers of highly-skilled British workers were drawing pay that was inferior to that given to many of their fellow-countrymen who were not nearly so capable of adding to the country's production of goods which we needed to export to pay for one-half of our daily food. That inequality of pay for services rendered undoubtedly operated to-day to reduce efficiency in many of the engineering shops in this country. In spite or that heavy handicap, many of the workshops of this country were now giving a pre-war service for something which could scarcely be called a pre-war wage. They were, however, in the electrical industry, he believed, at any rate steadily moving towards a solution of this difficulty. Electricity suppliers were beginning to lower prices, and what was perhaps equally important, they were making the supply better known. Considerable experience of the better business resulting from the electrification of railways, factories, docks, collieries, &c., had made those in control of such undertakings set about further extensions in order to make still better business. Manufacturers, too, had made great strides in the direction of providing good and reliable appliances for converting the cheaper supplies of electrical energy into the various forms of heat, light, and power most useful to the public. For many years manufacturers of electric lamps and firms like their own had persistently pressed, by publicity of all sorts, the electrical idea on the people of this country. All that work culminated in the magnificent effort at the British Empire Exhibition last year with an expenditure of over £1,000,000, and they were now actively engaged in providing means for following up that big work. In conclusion, Mr. Berry referred to the "Tricity" apparatus which the company manufactured for home and business use, and appealed to the shareholders to make use of the apparatus themselves and recommend it to their friends.

Automatic Telephone Manufacturing Co., Ltd.

The annual meeting of the company was held on April 7th, Sir Alexander Roger, the chairman, presiding. In presenting the report and accounts (*vide* Elec. Rev., March 13th, p 427), the chairman first referred to the death, in December last, of Sir Andrew Ogilvie, a member of the board. Continuing, he said that for the third year in succession the directors were able to submit a considerably better state of affairs, and the report could be regarded as highly satisfactory. The profit for the year at £137,836 compared with £95,167 for 1923 and £42,258 for 1922. The output for 1924 was the largest since the formation of the company. The ordinary share capital stood at £500,000, the increase having been brought about by the issue in October last of the remaining 140,000 ordinary shares. A further sum of £20,000 had been allocated to the reserve fund, which now stood at £25,000. Sundry creditors at £132,127 were up by nearly £30,000, due to the necessity of increased purchases to cope with the larger output. On the assets side the additions to plant and machinery, &c., showed an increase of £41,000. This was more than compensated for by the allowance for depreciation of £50,000. The whole of the issue of £210,000 6½ per cent. tax-free debentures would be rapid on July 1st next, and if it was found necessary to create a fresh issue it would no doubt be possible to do so on a more favourable basis. In the meantime the company was not pressed for capital. 1924 had been a year of immense effort. At the same time as the factory was working at full capacity they had to undertake the provision of new buildings and additions to their plant as well as the training of *personnel*. Owing to the highly specialised nature of the company's manufactures, it was essential to provide the best and most modern type of labour-saving machinery. They were fortunate in being able to draw on the organisation and resources of the Automatic Electric Co. of Chicago, with whom they had close reciprocal arrangements. That company's unique experience and leadership in the development of the Strowger system of automatic telephony was acknowledged the world over. The company had on its books large orders for London and for many provincial towns in the country. In the foreign field it was occupied with important work for Tokio, Buenos Aires, and Sydney. They had large numbers of students in their works, and this training scheme was already bearing fruit. The Strowger system had been selected as being the most suitable for the telephoning of London, which was probably the most complex telephone problem ever dealt with. He was sure that as time advanced, the decision of the Post Office would be justified. The example of the British Post Office was followed by other administrations and public authorities throughout the world. Inquiries for Strowger automatic equipment had sprung up in many directions, and were likely to lead to a considerable amount of business in the future. The magnitude of the task involved in adequately telephoning this country was not generally appreciated. If conversion from manual to automatic was the only work to be done, it alone would be a severe strain, but, in addition, there was the normal growth to be taken care of besides the accumulated arrears of development arising out of the war and other circumstances. That this great work was being carried on with so little inconvenience to the public was a tribute to the efficiency of the organisation which had been built up by the Telephone Department of the Post Office. Collaboration between manufacturers should go further so that the resources of the industry in manufacturing, engineering, and research would be collated and made available to the Post Office in a manner calculated to expedite work. There was a large amount of foreign busi-

ness to be had, and it was only by taking advantage of their combined strength that British manufacturers would successfully compete with the combinations that existed in other countries. The company's departments dealing with railway and mine signalling, wireless and domestic electrical appliances were proceeding satisfactorily. They were about to complete arrangements for the further extensive exploitation of these departments. Referring to the recently-formed Telephone Development Association, the chairman said that the telephone industry, with its many ramifications, already afforded employment for over 100,000 people. Apart from the big industrial wage bill represented by this figure, the Post Office telephone branch paid out well over £5,000,000 per annum in wages. There was no reason why the telephone manufacturing industry should not give employment to a further 100,000, and there was no reason why the Post Office should not double its telephone staff and pay double the present amount in wages. To get this country into its proper position would mean the immense capital expenditure of £150,000,000, at least 50 per cent. of which would go in wages.

In conclusion, Sir Alexander said that, although it was hazardous to prophesy, he was justified in saying that the orders on the company's books and the prospects generally were such as to keep the factory capacity fully taxed for some time to come, and it was more than likely that further expenditure on machinery and buildings would be necessary to cope with the demand for telephones, which he was convinced would materially increase.

International Automatic Telephone Co., Ltd.

The meeting of this company was also held on April 7th, when Sir Alexander Roger, who again presided, said that the year's figures showed a further improvement, the profit having risen from £26,829 to £31,591. The balance carried forward was equivalent to about 3 per cent. on the deferred shares, but it was considered advisable not to distribute it. If, however, the progress continued, the prospects of a dividend on those shares appeared to be good. The balance of the ordinary share capital (£144,605) was issued during the year at a premium of 6d. per £1 share. In conclusion, the chairman reviewed the work of the Automatic Telephone Manufacturing Co., Ltd.

Western Union Telegraph Co., Inc.

The report for the year ended December 31st, 1924, records a gross operating revenue of $112,861,555. A balance of $12,336,682 is transferred to the surplus account, and the addition of $51,814,706 brought forward makes available $64,151,887. Dividends paid and declared absorb $6,982,929, and adjustments of surplus $188,432, leaving a surplus at December 31st of $56,980,027. A total of $16,747,283 was expended on plant extensions and improvements during the year. This included the substitution of underground cables for aerial lines in congested centres, and the erection of 50,000 miles of wire. About 61 per cent. of the company's telegraph business is now handled automatically. At December 31st, 1924, the system comprised, generally, 214,431 miles of pole lines, 1,562,500 miles of wire (52 per cent. copper); 2,962 miles of land-line cables; 25,459 nautical miles of ocean cables; and 24,478 telegraph offices.

During the year a contract was made with the Radio Corporation of America for the transfer to or from Western Union lines at San Francisco of trans-Pacific radio messages directed to, or received from, points reached by the Radio Corporation and its connections. The company's new cable between New York and Horta, Fayal, Azores Islands, was successfully laid during the year. This cable is of the new type, loaded with "permalloy," and is the first of its kind to be laid; it has a capacity of 1,500 words per minute. Arrangements have been made to lease two or more of the "channels" to the Commercial Cable Co. The German Atlantic Cable Co. is arranging to manufacture and lay a loaded cable between Emden and Horta, where it will connect with the Western Union and Commercial Companies. With the consent of the other cable companies concerned, the Commercial and Western Union Companies have arranged to waive, in favour of each other, the exclusive features of their contracts affecting Eastern and Italian Company traffic, so that with the establishment of a direct cable service to Italy, the company will for the first time participate in Eastern Co. traffic.

London Electric Wire Co. and Smiths, Ltd.

In the course of his speech at the annual meeting on April 7th, the chairman, Sir George H. Fisher-Smith, said that there had been a largely increased turnover during the past year. Having regard to the narrow margin of profit which was now secured, it was essential that the turnover should be a large one if the business was to be remunerative. It was also necessary to increase the efficiency of productive methods. Throughout the year there had been continued harmony between the management and the employés. The chairman said that British trade was still suffering severely from the heavy burdens of taxation, which had reduced the consumers' capacity to purchase additional machinery or to carry out necessary plant replacements. It was to be hoped that some remission of this burden would be obtained in the near future, or manufacturers would be unable to develop new enterprises and thus reduce unemployment. There were signs that during the next few years heavy Continental competition would have to be met. If there was a revival of trade, the electrical industry, with which they were concerned, must benefit, and the company might look forward to a period of increased prosperity.

Bombay Telephone Co., Ltd.

Our Indian correspondent states that the company made a profit of about Rs. 7 lacs during 1924, but as out of this Rs. 5 lacs were carried to depreciation reserve, a dividend on ordinary shares of only 2 per cent. has been declared. The general depression of trade during the year has had a very detrimental effect upon the business of the company, the increase in the number of subscribers being only 56. There were on December 31st, 1924, 10,898 lines, of which 9,258 were in Bombay, 1,228 in Karachi, and 412 in Ahmedabad. The revenue increases during the year were Rs. 26,000 in Bombay, Rs. 16,500 in Karachi, and Rs. 7,500 in Ahmedabad. It was necessary during the year to call up a further Rs. 10 lacs of the debenture stock issue, making a total of Rs. 70 lacs called up. The automatic system brought into operation during the year has given satisfaction. With further extensive additions to the underground cables carried out during the year and as a result of the elimination of a considerable portion of the overhead wiring, a marked improvement has taken place in the service.

Babcock and Wilcox, Ltd.

The net profit for the past year was £760,300, and the amount brought forward £187,767, making £948,067. After the payment of dividends (including a total distribution of 12 per cent., free of tax, on the ordinary shares), £150,000 is placed to reserve (raising it to £400,000); £50,000 to the dividend equalisation fund (making £350,000); and £20,000 to the staff pension fund; leaving £197,395 to be carried forward. The report states that additional buildings and plant are in course of erection to enable the company to cope with the increased size of boilers for high pressures which are at present in demand. The company has also acquired additional freehold engine and boiler works, with machinery and plant, at Lincoln. The recent death of Mr. W. D. Hoxie, a director, while on his way to South America, is mentioned in the report.

Gateshead and District Tramways Co.—The report for 1924 shows a total revenue of £138,340. After the deduction of expenses, including £10,000 for renewals, there remains a balance of £30,769, to which is added £22,258 brought forward, making £53,027. Sinking fund charges and preference dividends absorb £10,607; a dividend of 10 per cent. on the ordinary shares for the year requires £15,211; and a balance of £27,207 is carried forward. The expenditure on capital account during the year amounted to £15,616, mainly on the work of completing the doubling of the tramway track on the Heworth route. Mr. E. R. Soames has been elected chairman in the place of the late Mr. H. S. Day.

Oliver Pell Control, Ltd.—The report for 1924, which was submitted at the annual meeting held on April 6th, shows a net profit of £15,436, plus £3,186 brought forward. After paying the balance of 4 per cent. dividend on the preference shares to December, 1923 (£135), Corporation Profits Tax to December, 1923 (£588), and interim dividends at 8 per cent. on the preference and ordinary shares, a final dividend of 2 per cent. on both classes of shares (subject to income tax) is recommended; £5,000 is carried to reserve and £5,123 remains to be carried forward, subject to Corporation Profits Tax, 1924. Mr. J. M. G. Rees, who has been in the employ of the company for six years, joined the board in January.

Wycombe (Borough) Electric Light and Power Co., Ltd.—After providing for debenture interest, preference dividends, &c., and adding the amount brought forward, the accounts for 1924 show an available balance of £10,237. An interim dividend of 4 per cent., free of tax, on the ordinary shares absorbed £2,000, and it is proposed to pay a further dividend of 6 per cent., tax free, requiring £3,000. The general reserve fund receives £4,000; £500 is transferred to the superannuation provision account, and a balance of £737 is carried forward. To meet the extension of plant and mains which has become necessary, and to provide for the future, it is proposed to create 10,000 ordinary shares of £5 each.

Para Electric Railways and Lighting Co., Ltd.—The receipts and expenses for the year ended November 30th last have been converted at the current rate of exchange instead of at the fixed rate of 1s. 4d. per milreis as before. Thus the gross receipts are shown at £127,028, as against £104,538, and the net revenue, including interest, &c., at £33,665, as compared with £30,414. Expenses, income tax, and debenture interest and sinking fund exceed this amount by £11,210. In 1923 there was an adverse balance of £15,959. The debenture interest for the latter half of last year is still outstanding.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Shropshire, Worcestershire and Staffordshire Electric Power.—£650,000 5½ per cent. first debenture stock.

Westminster Electric Supply Corporation.—755,620 ordinary shares of £1 each, fully paid, Nos. 1 to 755,620 and 550,000 4½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,200,001 to 1,750,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Folkestone Electricity Supply.—50,000 ordinary shares of £1 each, fully paid, Nos. 50,001 to 100,000.

Vickers, Ltd.—The accounts for the past year show that the profit was £403,224 as compared with £499,555 in 1923. The amount at the credit of profit and loss is £804,544, but the directors do not propose to pay an ordinary dividend for the year. Foreign competition has been severe, resulting in a lack of sufficient orders to enable the company's profit-earning capacity to be maintained.

Northern General Transport Co., Ltd.—The net traffic receipts, &c., for the past year amounted to £92,603, and after deducting expenses, loan and debenture interest and £33,089 for renewals, a balance of £47,095 remains. To this is added £2,211 brought forward, making £49,306, which it is proposed to distribute as follows:—To reserve, £5,000; to debenture sinking fund, £2,000; preference dividend (6 per cent.), £9,000; dividend of 10 per cent. on 350,000 ordinary shares (2½ per cent. already paid), £25,000; leaving £8,306 to be carried forward. The capital has been increased to £500,000 by the creation of 100,000 ordinary shares of £1 each; 75,000 of these were issued in December last. The capital expenditure during the year was £76,623, and the value of investments at December 31st last was £419,788.

Woking Electric Supply Co., Ltd.—The balance available for 1924 (including £1,926 brought forward, and £133 interest) was £30,995. After paying the preference dividends and providing for income tax, there remained £20,685, which was distributed as follows:—To depreciation and renewals fund, £8,000; to reserve, £8,000; dividend of 10 per cent., free of tax, on the ordinary shares, £2,722; carried forward, £1,963. The number of consumers rose from 2,965 to 3,218, and the number of lamps connected from 238,573 to 261,489.

Folkestone Electricity Supply Co., Ltd.—An extraordinary meeting is to be held to-day (Friday), to confirm resolutions passed at the meeting on March 27th. These provide for the increasing of the capital to £200,000 by the issue of 50,000 shares of £1 each, of which 40,000 will be ordinary shares and the balance "employés' co-partnership shares"; the allocation of the latter shares to employés; and the capitalisation of profits as and when thought fit by the directors.

Jarrow and District Electric Traction Co., Ltd. — The total revenue for 1924 was £12,152, and after deducting expenses, including £800 for renewals, and adding £1,825 brought forward, there remains £3,187, which is to be carried forward. The report mentions the death of the chairman of the company (Mr. H. S. Day) and the appointment of Mr. E. R. Soames as his successor.

Mexborough and Swinton Tramways Co.—The report for the year 1924 shows a balance at credit of the net revenue account of £12,445; to this is added £530 brought forward, making £12,975. After providing for taxation and depreciation, a dividend of 3 per cent., free of tax, is to be paid, £5,000 is to be transferred to reserve and renewals account, and £772 carried forward.

Peterborough Electric Traction Co., Ltd.—The revenue for 1924 was £26,209, and the balance, after meeting expenses and debenture interest, and transferring £3,000 to the renewals fund, was £1,921. To this is added £419 brought forward, making £2,340. It is proposed to pay a dividend of 6 per cent. on the preference shares and to carry forward £1,020.

Singapore Electric Tramways, Ltd.—A meeting was held last week to approve the necessary resolutions for winding up the company for the purpose of carrying out the reconstruction scheme sanctioned by the Court.

Indo-European Telegraph Co., Ltd.—A final dividend of £1 2s. 6d. per share, free of tax, is recommended, together with a bonus of 7s. 6d. per share, free of tax, making a total distribution of 8½ per cent., tax free, for the year.

Wood & Cairns, Ltd. — In their annual report, the directors state that the 1924 trading results show an improvement and they recommend a dividend of 7½ per cent. on the ordinary shares, as compared with 5 per cent. for 1923.

National Electric Construction Co., Ltd.—The profit on the past year's working was £18,175, and the balance, after the deduction of debenture interest, &c., was £12,672, to which is added £4,404 brought forward, making £17,076. It is proposed to allocate this as follows:—Reserve and renewals account, Dewsbury and Ossett Tramways, £1,084; dividend equalisation reserve, £1,000; general reserve, £5,000; dividend of 8 per cent., £5,270; leaving £4,721 to be carried forward. The report states that the progress of the various undertakings in which the company is interested has again been satisfactory, and the volume of contracting business has been well maintained. Meeting: April 23rd.

Telephone Manufacturing Co., Ltd. — The accounts for the nineteen months ended at December 31st last, show that up to the end of May, 1924, a loss of £55,000 had been sustained, but after taking into account dividends amounting to £47,984, the loss for the whole period was reduced to £40,057. The combined accounts of the 13 British installation companies show a total profit of £68,576 and a balance available for dividends to the parent company of £26,427. Meeting: April 21st.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange markets returned from the Easter holidays to find very little business awaiting them. There was a general air of expectation about the House, but it failed to materialise into activity. Members of the Stock Exchange have to fall back upon the excuse that their clients await the Budget before they, the clients, care to take any vigorous hand in stocks and shares. There is some vague talk about the possibility of a reduction in the Bank Rate to the previous level of 4 per cent., while the Budget is anticipated with feelings of cheerfulness combined with curiosity. New issues continue to meet with good support in the cases of those that offer sound stock at reasonable figures.

County of London ordinary shares have risen to 55s. on a good deal of quiet support, which has come upon a market none too freely supplied with shares. St. James's and Pall Mall are also better at 13¾. Westminster ordinary are now officially quoted at 43s., equivalent to 10¾ for the shares in their recent £5 denomination. In the provincial group, Folkestones keep their rise. Yorkshire Electrics have risen to 30s. 6d.; Lancashire Light & Power are better at 28s.; Edmundsons are a good market with a rise of 1s.; Urbans are steady; London Electric Preference strengthened to 5 9/16ths; City of London Ordinary at 46s. 3d. are a few pence lower.

The Home Railway Market is harder. It is taken for granted that the time cannot be far distant when a thorough reorganisation will take place in the stocks and shares of the Underground Electric Railways of London. The ordinary shares at 2¾ are consequently ¼ harder. Districts strengthened to 49¼, on the announcement that the British Empire Exhibition will re-open on May 9th. Metropolitan Consolidated, however, remains unchanged at 78¼.

British Electric Traction stocks are both a point higher. The reason for this is the fact that trust companies' stocks of all kinds are greatly in demand. The British Electric Traction is now a holding company, and the dividend on the ordinary stock rose from 5 per cent. in 1923 to 6 per cent. last year. For some time past, persistent buying has absorbed every pound of stock which came to market, and the demand continues. On the present dividend, the ordinary stock looks high enough, but the scope for improvement is deemed sufficiently wide to justify the quotation, and it is likely to appreciate steadily as time goes on. London United Tramways debenture remains flat at 47¼. London and Suburban Traction preference continue depressed at 5s. 6d. The idea prevails that, in both cases, the current quotations may prove to be somewhere near the worst, though the purchase of either stock at the present time can only be regarded as risky.

Mexico Tramway Fives shed another 2 points to 66, this in face of rumours, not, however, generally believed, to the effect that the new President of Mexico means to assist with all his power the English-operating companies in the country. Anglo-Argentine Tramways are steady.

Something of a boomlet developed in cable manufacturing shares. The market explanation is that there is likely to be an increase before long in the dividends paid by the leading companies. Callenders rose to 67s. 6d., and Henleys to 64s. 6d., Johnson & Phillips to 32s. 6d. bid. The other shares in the same group are firm without showing quotable movements. Obviously the present dividends hardly justify quotations in standing at their current levels, but the buying has been so knowledgeable as to lead to the assumption just mentioned that it will not be long before the rates are advanced. Telegraph Constructions are still 27, at which the yield on the money is 4¾ per cent., paid free of tax.

In the Marconi group the parent shares are a somewhat dull market at 35s. sellers, and the new shares, 5s. paid, keep about 10s. 3d. Canadian Marconis at 5s. 4½d. are rather under the influence of selling of the new shares. Radio Common rose to 11¼, the preferred being steady at 10¾. The Indo-European Telegraph Co. announces a final dividend of £1 2s. 6d. per share, tax free, making 7 per cent. for the year, and a bonus of 7s. 6d. per share, tax free, a total of 8½ per cent. for the year. This compares with 7 per cent. paid previously for the past three years. No change has occurred in the price, which remains at 32½, but the announcement has been received with pleasure by those who are interested in cable stocks as a whole as being indicative of the state of cable business. Eastern Ordinary retains its rise of 2½ at 176½, and the other members of the Eastern group show no alterations. The Telephone Manufacturing report is to be amplified, by a full explanation of the company's present position, at the meeting next Tuesday. The 8 per cent. bonds remain at 97½.

Babcock & Wilcox hardened a trifle on the issue of the report. The figures are considered good, and have counteracted the slight disappointment at there being no increase in the dividend rate. Vickers have gone back further, to 8s. 1½d., on the passing of the dividend mentioned here last week. The report held little with which to console the shareholders. Iron and steel shares move narrowly and irregularly. Some people hope that the Chancellor may disclose plans, in his Budget speech, for assisting the state of trade in the "heavy" industries. The price of rubber flatters proprietors of shares in the companies concerned with its production, but business is at a low ebb.

Inquiries to the ELECTRICAL REVIEW, relative to stocks and shares, can be dealt with only in this column, either directly or indirectly. If any service can be rendered in this direction, it will be, of course, readily given upon such matters as are germane to the industry. One condition which must be politely stipulated is that the questions shall be brief and to the point.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	1924.	Price April 14 1925.	Rise or fall.	Yield. p.c.
Bournemouth and Poole ...	1	18	1/4	2⅝	—	5 1 10
Brompton Ordinary	1	10	10	1⅛	—	*5 10 4
Charing Cross Ordinary	1	14½	15	45/-	—	6 13 4
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	38/9	—	6 4 0
City of London	1	15	15	2⅛xd	—6d.	6 9 10
do. do. 6% Pref. ...	1	6	6	30/6xd	—	5 2 2
Clyde Valley	1	8	8	22/6	—	4 18 6
County of London	1	15	15	2⅝	+ ⅛	5 9 1
do. do. 6% Pref. ...	1	6	6	26/-	—	5 4 4
Edmundson's Ordinary	1	7	—	24/6	+1/-	5 14 2
do. 7% Pref.	1	6	—	22/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12⅝	—	5 18 10
Lancs. Light and Power ...	1	7½	7½	26/-	+6d.	5 7 1
London Electric	1	10	10	36/6	—	5 9 7
do. do. 6% Pref. ...	5	6	6	5⅞	+ ⅛	5 7 7
Metropolitan	1	10	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 3
Newcastle-on-Tyne Ordinary ...	1	6	7	23/9	—	5 17 11
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1⅛	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	138	+ ½	6 10 10
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...		7	7	1⅝	—	5 12 0
Urban Ordinary	1	4	—	1⅛	—	3 15 4
do. 6% Pref. ...	1	6	—	20/6	—	5 17 1
Westminster Ordinary	1	15	15	43/-	—	6 19 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	—	7 12 11
Yorkshire Elec.	1	8	8	30/6	+6d.	5 5 0

Home Rails.

Central London Ord. Assented Stock	4	4	69	—	5 15 11
Metropolitan ... ... ,,	4	5	78½	—	6 7 5
do. District ... ... ,,	3½	3½	49½	+ ½	7 1 5
Underground Electric Ordinary	10	Nil	Nil	2⅛	+ ⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	—	Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

Telegraphs and Telephones.

		Dividend. 1922.	1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	Nil	8	1⅞	—	3 8 7
Chili Telephone	5	6	6	5½	—	*5 9 1
Cuba Sub. Ord.	10	7	7	7½	—	9 18 2
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord.	Stock	10	10	176½	—	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	82	—	6 17 6
Indo-European	25	7	7	29½	—	*6 10 9
Marconi	1	15	10	1⅞	—	5 14 6
Marconi Marine	1	10	10	1⅛	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2⅛	—	*5 12 11
United R. Plate Tel.	5	8	8	7	—	*5 13 0
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	8¾	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	9	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	73	—	6 17 0
British Electric Traction Ord. ...	,,	5	5	105½	+1	5 13 10
do. do. 6% Pref. ...	,,	6	6	106½	+1	5 12 8
Brazil Traction	100	4	4	53	—1	7 8 2
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	89½	—1	5 11 9
do. do. Preferred	,,	5	90/-	88½	—	*5 8 4
do. do. Deferred	,,	8	129/6	106½	—	*6 1 6
do. do. Deb.	,,	4½	4½	78½	+1	5 8 3
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	66	—2	7 11 6
Mexican Light Common ...	100	Nil	Nil	26	+1	Nil
do. Pref.	100	Nil	Nil	67	—	Nil
do. 1st Bonds ...	—	5	5	67½	—	7 8 2
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0

Manufacturing Companies.

Babcock & Wilcox	1	20	12	52/6	—	*4 11 5
British Aluminium Ord.	1	5	6	1⅛xd	—9d.	3 1 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	8⅛	—	4 17 11
Brush Ord.	1	10	10	28/3	—	7 12 4
Callenders	1	15	15	3⅜	+ ⅛	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	... ...
Edison-Swan	4/-	7½	10	7/6	—	5 6 8
do. 5% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	53/9	—	5 19 10
Enfield Cable, Pref.	1	7½	7½	1⅛	—	6 0 0
English Electric	1	8	5	18/3	—6d.	5 9 7
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	23/-	—	4 16 11
Henley	1	15	15	61/6	+9d.	4 13 0
do. 4½% Pref.	5	4½	4½	4⅛	—	5 6 0
India-Rubber	1	10	5	20/-	—	*5 0 0
Johnson & Phillips	1	5	5	1⅛	—	8 1 6
Met-Vickers, Ord.	1	12½	8	94/6	—	6 10 8
do. Pref.	2	8	8	2⅛	—	6 8 0
Siemens Ord.	1	5	—	25/9	—9d.	3 17 6
Telegraph Construction	12	20	20	97	—	*4 14 1

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price April 15.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	8½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£93	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3⅝d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net	£215	£3 dec.
Grade II ... ... ,, ,,	£155	£7 dec.
Grade III ... ... ,, ,,	£89	£4 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11⅛d. to 1/-	½d. dec.
c ,, Wire, basis ... ... ,,	9⅛d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	½d. dec.
c ,, Bars (best selected) ... per ton	£90	...
c ,, Sheet ... ... ,,	£90	...
c ,, Rod ... ... ,,	£90	...
d ,, (Electrolytic) Bars ... ,,	£64	5s. inc.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£75	5s. inc.
d ,, ,, H.C. Wire per lb.	9⅛d.	⅛d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	3/6	...
h India-rubber, Para fine ... ... ,,	1/7	½d. inc.
l Iron Pig (Cleveland Warrants) ... per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual, ,,	£20	—
g Lead, English Pig ... ... ,,	£23 15s.	50s. dec.
g Mercury ... ... per bot.	£13 15s.	5s. to 10s. dec.
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/5½	½d. dec.
p ,, ,, wire ... ... ,,	1/3½	½d. dec.
e Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/6½	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£231 to £231 10s.	£6 dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Mathey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Measurement of Frequency.—It has been customary during the past three decades to define the oscillation-frequencies of "wireless" in terms of the lengths, in metres and kilometres, of the corresponding ether waves. During the past few years there has arisen a tendency to abandon the indirect definition and to state the frequencies themselves, in cycles per second, or in kilocycles per second. In a recent paper before the Wireless Section of the Institution of Electrical Engineers, entitled "The Measurement of Frequency and Allied Quantities in Wireless Telegraphy," Lieut.-Col. K. E. Edgeworth and Mr. G. W. N. Cobbold, A.M.I.E.E., suggest as a further alternative the description of frequencies in terms of "pitch," a term which is defined as a relationship of the particular frequency to some standard frequency. The proposed standard is the frequency of 1 cycle per second, and the relationship suggested is that the "pitch" is a logarithm of the ratio between these frequencies. Some of the possible advantages of the use of "pitch" are described, and particular emphasis is laid on the advisability of employing it in the case of very short waves.

A "Safety First" Journal.—We have received the first issue (April, 1925) of *Safety First*, a new monthly and the official journal of the National "Safety First" Association. The issue opens with a "Foreword" by the President of the Association (1925), Sir Wm. Joynson-Hicks, Bart., M.P. Letters and articles by H.R.H. The Duke of York, Rear-Admiral Sims (U.S.A.), Sir Thomas Legge, Senior Medical Officer to the Home Office, and the Chief Constable of Stoke-on-Trent, are interesting features of the journal. The price is 1s. to the public, while to the members of the Association it is *gratis*. We trust the journal will enjoy the success which the movement behind it deserves.

Intervalve Transformers.

The Amplification of Audio-Frequency Vibrations.

By C. H. NAYLOR, A.M.Inst.C.E.

(*Concluded from page* 591.)

(i) If the capacity of the secondary is large, I_2 is large, and it increases greatly at high frequencies; accordingly M_2 increases, and with it M_1, this increases c_2, and c_2 is again increased if the primary capacity is large. If the resistance of the valve is large, c_2 R becomes very great at high frequencies.

(ii) Now, following the e.m.f. side, if the leakage flux ψ_2 is great, ϕ is reduced at high frequencies, and with it f_2, but f_2 may be increased or decreased with primary ψ_1 depending on the phase position of M_1; generally ψ_1 operates to increase f_2, at low frequency and to decrease it at high frequency. However, the main effect is ψ_2, and this is always to decrease f_2, which becomes marked at high frequency. From f_2, R is calculated and e follows.

(iii) As frequencies increase, the general effect is for c_2R to increase, as shown in (i), but for e to decrease, as shown in (ii).

resultant vector g of as equal value as possible throughout the musical scale of frequencies.

An example will show these points more clearly, and at the same time it will be useful to note that many of the values above referred to are negligible and can be eliminated without affecting the final results.

Let the transformer under consideration have—

Primary turns $5{,}000 = T_1$.

Secondary turns $25{,}000 = T_2$.

Section of iron .631 sq. cm. $= a$.

Length of magnetic path 16 cm. $= l$, so that

$$\mu\, a/l = 131.$$

$$\mu_2\, a_2/l_2 = .028.$$

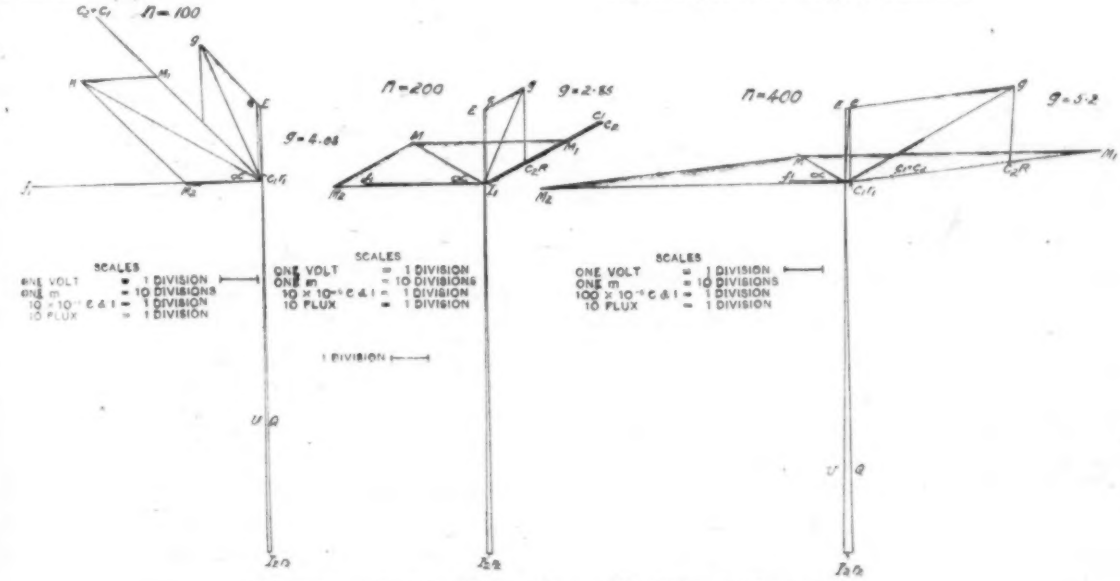
Capacity of secondary $= .001033 \times 10^{-6}$ farad $= K_2$.

Capacity of primary $= .00056 \times 10^{-6}$ farad $= K_1$.

Resistance of secondary $= 9{,}380$ ohms $= r_2$.

Resistance of primary $= 938$ ohms $= r_1$.

Resistance of valve $= 35{,}000$ ohms $= R$.



Figs. 7, 8, and 9.—Vector Diagrams for n = 100, 200, and 400 respectively.

(iv) In order to have g as small as possible in relation to Q, c_2R and e must be small.

(v) Now, c_2R can predominate over e at high frequencies, and e can predominate over c_2R at low frequencies; the result is generally poor amplification at low and high frequencies, but maximum at the middle register.

(vi) The design should be such that c_2R and e give a

Six vector diagrams, figs. 7 to 12, are drawn for n = 100, 200, 400, 800, 1,600, and 3,200; these represent octaves in the musical scale.

The accompanying list shows the process of the calculations at different frequencies, and the vector diagrams are referred to for such values as are more conveniently obtained from them.

Many of the values are so small that it is impossible

TABLE OF AMPLIFICATION.

Let Q = 10 n =	100	200	400	800	1,600	3,200
$I_2 = 2\pi n K_2 Q$	$6{\cdot}5 \times 10^{-5}$	13×10^{-5}	26×10^{-5}	52×10^{-5}	104×10^{-5}	208×10^{-5}
$I_2 r_2$	·061	·122	·244	·488	·976	1·952
$M_2 = 4\pi r_2 I_2/10$	·204	·408	·816	1·632	3·264	6.528
$\psi_2 = \cdot 028\ M_2$	·00571	·01142	·02285	·0457	·0914	·1828
U from diagram	10	10	10	10	10·05	10·1
$f_1 = U \times 10^6/2\pi n T_2$	63·7	31·85	15·925	7·962	4·0	2·01
$\phi = f_1 - \psi_2$	63·7	31·84	15·9	7·9	3·91	1·827
$M = \phi/131 \cos \alpha$	·56	·28	·14	·0696	·0345	·0161
M_1 from diagram	·4	·22	·8	1·55	3·2	6·52
$C_1 = M_1 \times 10/4\pi T_1$	$63{\cdot}5 \times 10^{-6}$	$35{\cdot}1 \times 10^{-6}$	$127{\cdot}5 \times 10^{-6}$	247×10^{-6}	510×10^{-6}	$1{,}035 \times 10^{-6}$
$R = 2\pi n T_1 \phi/10^6$	2·0	2·0	2·0	1·985	1·96	1·84
$C_1 r_1$	·0598	·0329	·112	·232	·478	1·065
e from diagram	2·04	2·01	2·04	2·01	2·1	2·3
$I_1 = 2\pi n K_1 e$	$·718 \times 10^{-5}$	$1{\cdot}41 \times 10^{-5}$	$2{\cdot}87 \times 10^{-5}$	$5{\cdot}62 \times 10^{-5}$	$11{\cdot}8 \times 10^{-5}$	$25{\cdot}9 \times 10^{-5}$
I_1 is so small that C_2 is taken equal to C_1 so that						
$C_2 R$ =	2·23	1·23	4·47	8·65	17·85	36·2
g from diagram	4·08	2·85	5·2	9·15	19·0	37·6
Q/G_1 = amplification = 10 n/g; if n = 7, Q/G_1 = 70/g						
Q/G_1 =	17·15	24·7	13·45	7·65	3·68	1·86

to indicate them on the diagrams. Different scales can be used for different kinds of quantities; for instance, if all the vectors showing voltage are drawn to the same scale, and all the magnetomotive force vectors to a scale of their own, also the flux and current vectors each to its own scale, it is not necessary that all the scales should be alike. When, however, in any one kind the value of one is very small compared with another of the same kind, it is impossible to show the smaller value, as in the case of f_1 and ψ_2, also e and $c_1 r_1$ at the lower frequencies, and the value ψ_1 is too small to appear in conjunction with ϕ.

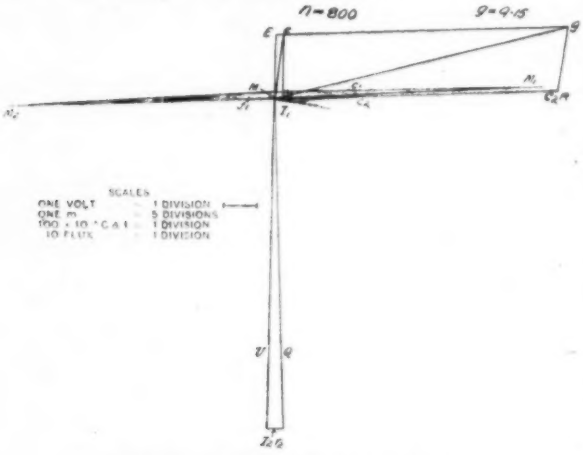


Fig. 10.—Vector Diagram for $n = 800$.

It will also be observed that ϕ very nearly $= f_1 - \psi_2$, and that f_2 very nearly equals ϕ. I_1 is exceedingly small, so that C_2 is nearly equal to C_1, and can be made equal for all practical purposes.

The results shown by the diagrams and tables are remarkable, and with such a transformer the amplification on the high frequencies is poor. The frequency $n = 3{,}200$ is about the top note on a full-size piano, and it is very rare that such a note occurs in music, but nevertheless, there are such frequencies as harmonics in every note sounded by musical instruments, and it is the presence of these harmonics that gives character or quality. The absence of these harmonics in reproduction leaves music flat and colourless.

Observing the values of e, the voltage change at the terminals of the primary, and comparing with the constant value Q assumed 10 at the secondary terminals, it will be seen that the ratio 5 to 1 is fairly well maintained.

The trouble is, however, that the ratio of volts change between grid and plate of the first valve is not maintained. Observe the value C_2, which is so nearly equal to C_1; C_2 increases with the frequency, but not proportionally to it.

At a frequency of 3,200 this current value is a little over one milliampere. This current alone is equivalent to a voltage change in the first valve of 36.2 volts, and the volts change of the plate is 2.3 volts. If these were in phase, the total volts change on grid would be $38.5/F$ = say 5.57 to give a volt change Q = 10 on the grid of the second valve. This rough estimate gives an amplification of $10/5.5 = 1.82$. The actual amplification is as given in the table, namely, 1.85.

The original cause of this comparatively large current at the high frequencies is, of course, the capacity of the secondary of the transformer.

A current in the secondary, whether leading or lagging, must have a correspondingly larger current in the primary depending on the ratio of transformation and other factors. This current has to be supplied by the valve and through its resistance, as well as through the resistances of both primary and secondary, hence the loss in amplification. The loss due to primary and secondary resistances is small compared with the loss in the valve.

As before mentioned, there are certain values that can be ignored, and these same values become smaller and smaller as capacities are reduced, as would be the case in improved designs. For instance, as K_2 is reduced, U is practically equal to Q, and $\phi = f_1 - \psi_2$; $f_2 = \phi$, because ψ_1 can be ignored. As K_1 is made small, C_1 and C_2 can be considered equal. It follows also that $(R + r_1)$ can be treated as one resistance, and $C_1 (R + r_1)$ replaces $C_1 r_1$ and $C_2 R$.

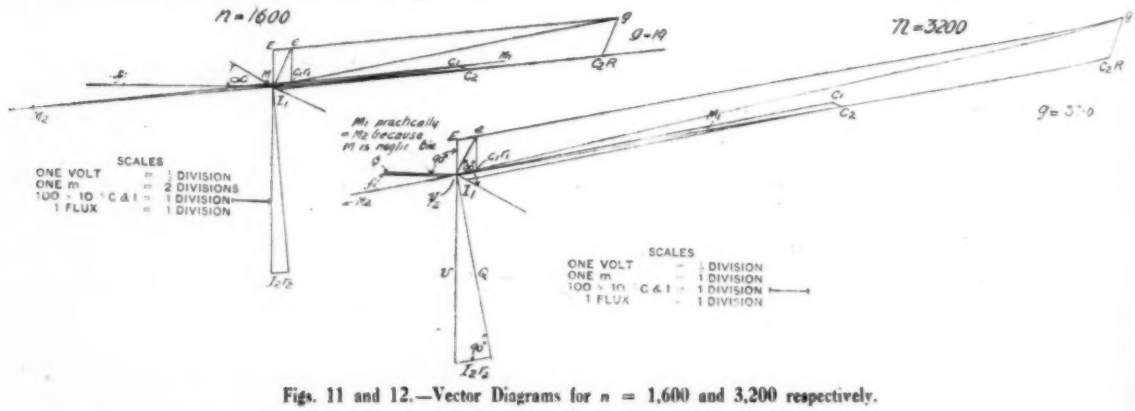
Eliminating these negligibles, the author has constructed the following formula, which is sufficiently true for all reasonable designs of transformer and easier to handle than the vector diagrams:—

$$g^2 = \frac{Q^2}{16\pi^2 T_1^2}\frac{100\,(R + r_1)^2}{}\left[\frac{64\pi^4 T_1^2 n^2 K_2^2}{100}\left(1 + \frac{2\mu_2 a_2 l}{\mu a l_2}\right) - \frac{4\pi K_2 10^7}{D}\right] + M^2\left[\frac{100\,(R + r_1)^2}{16\pi^2 T_1^2} + \frac{(R + r_1)\,n\,D}{2 \times 10^7} + \frac{4\pi^2 T_1^2 n^2 D^2}{10^{16}}\right] \quad \ldots (12)$$

$$\text{Where } M = Q\left(\frac{10^5}{2\pi n T_2} - \frac{\mu_2 a_2 8\pi^2 T_2 n K_2}{l_2 \times 10}\right)\frac{1}{D} \quad \ldots (13)$$

$$D = (\mu a/l) \times \cos \alpha.$$

Q = the volts change on the second grid simultaneous with G_1 of the first grid.
R = resistance of valve in ohms.
T_1 = turns in primary.
n = audio frequency.
r_1 = resistance of primary, ohms.
T_2 = turns in secondary.
K_2 = capacity of secondary, farads.
$\mu a/l$ = permeability × area/length of magnetic path in cm. and sq. cm.
$\mu_2 a_2/l_2$ = permeability × area/length of secondary leakage path in cm. and sq. cm.


n=1600
g=9·19
n=3200
SCALES
ONE VOLT = 1 DIVISION
ONE m = 2 DIVISIONS
100 × 10⁻⁸ C & 1 = 1 DIVISION
1 FLUX = 1 DIVISION
SCALES
ONE VOLT = 1 DIVISION
ONE m = 1 DIVISION
100 × 10⁻⁸ C & 1 = 1 DIVISION
1 FLUX = 1 DIVISION

Figs. 11 and 12.—Vector Diagrams for $n = 1{,}600$ and 3,200 respectively.

When once all the values are filled in this formula, except the values of n, a complete set of values of g^2 can be obtained for different values of n.

To find g, of course the square root of each result must be taken then as before—

$$G_1 = g/F \text{ and } Q/G_1 = QF/g.$$

With regard to the amplification with varying signal strength, it will be noted that if the ratio Q/g remains constant for various values of Q or g, then the amplification will be constant with varying signal strength. It will be seen by inspection of the formula that the right-hand side of the equation is directly propor-

tional to Q^2, whilst the left hand is g^2; obviously, then, any change in the value g will give proportional change in Q, which are the requirements for equal amplification with varying signal strength.

A few general observations may be made with regard to design.

The amplification at the lower frequencies will be considerably improved by increasing the magnetic impedance of the primary, either by increasing the number of turns or increasing the quantity of iron. Increasing primary turns, however, entails increasing secondary turns to maintain the ratio.

The amplification at high frequency is improved by reducing the capacity of the secondary.

For a given capacity in the secondary the amplification characteristic will be more equal with moderate ratios of transformation, say 5 to 1, than with extreme ratios, say 7 and 11 to 1. Amplification at the higher frequencies will be greater if the transformer follows a valve having low internal resistance. But valves with low internal resistance have also a large continuous current component. The induction in the iron is increased accordingly. The value of μ falls somewhat, causing lower impedance, and amplification on the lower frequencies suffers slightly.

A low-resistance valve, however, improves high-frequency amplification much more than it adversely affects amplification on the lower frequencies.

If the value C_2 R is comparatively equal to e at any frequency, then if the leakage value ψ_2 be increased, the amplification will be increased. But if e is small compared with C_2 R, then very little advantage is gained by increasing ψ_2.

Capacities of Intervalve Transformers.

The problem is to find an equivalent external capacity which will produce the same effect as the internal capacity of the windings. Within the windings the electrical quantities passing by way of the dielectrics

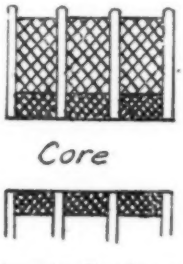


Fig. 13.—Intervalve Transformer Windings.

are not necessarily equal at all points; but if each quantity is determined separately and substituted by an equivalent quantity which, if passing through all the turns, will produce the same magnetising effect on the core, a total equivalent quantity can be substituted.

This quantity divided by the volts change at the terminals will give the equivalent external capacity.

$$K = Q/V.$$

Where K = equivalent external capacity.
V = volts change at terminals.

Take the case of a transformer wound in layers and sections as in fig. 13. Consider the secondary winding, there will be a capacity between wires horizontally and vertically equal to C_1 per turn; also a capacity across partitions C_2 per turn.

Capacity between wires per turn.

$$C_1 \text{ in microfarads} = k_1 S/(4\pi t_1 \times 900{,}000). \quad (14)$$

Where k_1 = dielectric constant
S = surface of wire in sq. cm.
t_1 = thickness of dielectric in cm.

Similarly

$$C_2 \text{ in microfarads} = k_2 S/(4\pi t_2 \times 900{,}000).$$

Where k_2 and t_2 are the dielectric constant and the thickness of the dielectric respectively of the partition.

It can be shown that the mean turn can be taken for the purpose of calculating the surface S. The volts per turn $= V/T_2$, where V is the external volts change between terminals and T_2 the total number of turns. This is true, because the induced e.m.f. resulting from the flux change in the core is equal per turn.

Now, with regard to the quantities q_1, q_2, &c.

Between each wire horizontally

$$q_1 = VT_2C_1/T_2 = VC_1. \quad (15)$$

This quantity is common to all turns.

Between layers.

Volts between layers $= VT_1/T_2$
where T_1 = turns per layer.

The quantity passing between each turn of one layer and the next passes through all the turns of one layer and occurs L times in every partition, and again P + 1 times where P is the number of partitions and L is the number of layers per partition.

$$q_2 = VT_1C_1 \times T_1L \times (P+1)/T_2,$$

but since $T_1L \times (P+1) = T_2$

$$q_2 = VT_1C_1. \quad (16)$$

Between partitions.

Volts between partitions $= VL/T_2$.

There are L quantities passing between the turns adjacent to the partitions, and this occurs P times.

This value $= VL\ C_2\ LP/T_2$.

The equivalent quantity to be sent through all the turns to produce the same effect is—

$$q_3 = V\ L^2/T_2 \times P\ C_2/T_1 \quad \ldots \quad \ldots \quad (17)$$

Adding the quantities, q_1, q_2, and q_3

$$\text{Total quantity } Q = V\ C_1 + V\ T_1\ C_1 + V\ L^2\ P\ C_2/T_2\ T_1 \quad (18)$$
$$= V[C_1(1 + T_1) + L^2\ P\ C_2/T_2\ T_1].$$

Equivalent external capacity—

$$K = Q/V = C_1\ (1 + T_1) + L_2 P C_2/T_2 T_1 \quad (19)$$

It will be found that K reduces with T_1 up to a point for a given thickness of partition. By increasing the thickness of the partition a further reduction of K can be obtained by again reducing T_1.

Conditions in Chile.

Mr. W. F. Vaughan Scott, Commercial Secretary to the British Legation at Santiago, has forwarded a report, dated September, 1924, to the Department of Overseas Trade dealing with the industrial and economic situation in Chile.*

In his opening remarks Mr. Scott aims at showing the importance of Chile to Great Britain from the financial and commercial points of view. Chile occupies the third position of commercial importance among the South American Republics so far as Great Britain is concerned. Our total trade in 1924 with the three principal Republics was as follows:—Argentina £107,000,000, Brazil £19,000,000, and Chile £17,000,000. In addition to this there is over £100,000,000. of British capital invested in Chile; this is confined principally to State and municipal loans, railway and public utility companies, and nitrate mining. Mr. Scott says that although trade does not follow capital, there is no doubt that its investment in the industries of the country has had the effect of securing trade which would otherwise have been lost.

During the period under review Chile experienced a gradual revival of trade activity, and in spite of the unsettled political conditions there was a favourable trade balance in 1923 owing to the increased nitrate exports. Copper exports were also higher. Important developments have taken place in the utilisation of hydro-electric power; radio-telegraphy has made great strides; and broadcasting has become very popular, the demand for apparatus having been supplied principally by American manufacturers. In the labour market there is a shortage of workmen, and salaries and wages are at a high level. A scheme to promote immigration from Germany is being studied.

Trade Prospects.

Future prospects of trade with Chile are good; the principal competitors are the United States and Germany. There is abundant evidence that great progress has been made

* Stationery Office. 3s. net.

throughout the country during the last few years; cities have expanded, industries have grown, and the material conditions of the people have improved, all of which means increased needs and increased purchasing power. Beyond the principal articles of import, such as textiles, hardware, &c., there will be special openings for machinery and plant for the modernising of nitrate "oficinas," material for State and private railways, material for hydro-electric developments and port work improvements, material for railway electrification and electric railway construction, drainage works, industrial machinery, and supplies of semi-manufactured articles.

Copper and Coal.

According to Government statistics, the exports of copper ingots during the first nine months of last year totalled 130,787 tons, and the exports of ore amounted to 64,021 tons. In 1923 the equivalent figures were 158,536 tons and 94,144 tons. The report states that British mining, milling and smelting equipment is scarcely ever seen, and there seems to be little enthusiasm in pushing it forward. For electrical mining equipment German firms quote the lowest prices and give good delivery.

This appears to apply also to coal-mining machinery, for it is stated that a contract for the electrification of the Schwager Co.'s mines has been given to the Siemens-Schuckertwerke for £150,000. Owing to the development of hydro-electric power and the great increase in the use of electricity, mine owners anticipate a gradual reduction in the use of coal, and have asked the Government to impose an import duty on foreign coal and petroleum.

Hydro-Electric Development.

It is stated that Chile has at least 4,000,000 h.p. of unused water power, and there is little doubt that each year will see a steady increase in its use. The Cia. Chilena de Electricidad, which is controlled by a British company, has done much to develop hydro-electric power in Chile. The company supplies power to the electrified portion of the State railways (231 km.), many industrial concerns, the Valparaiso Tramway Co., &c., and it also operates the tramway system in Santiago with 110 km. of track and 440 cars. In four years the peak load of the company's system has risen from 13,000 kW to 30,000 kW. The company is already finding it difficult to supply all the power required, and it has decided to build a new 50,000-h.p. plant at a cost of between two and three million pounds sterling.

The Cia. Electricidad de Valparaiso is controlled by the same British company, and was formed in 1923 to take over the existing Cia. de Tranvias de Valparaiso, which includes a 5,500-h.p. hydro-electric plant. The latter is insufficient to meet the demand in Valparaiso, and current is taken from the Santiago company.

The largest hydro-electric plant in South America, says the report, is that at Tocopilla, belonging to the Chile Exploration Co., Ltd. From this station 60,000 h.p. is transmitted at 110,000 V to Chuquicamata, 140 km. distant, for use in the company's great copper mine. The company has also a thermal station, which it proposes to enlarge at a cost of about £2,000,000. The Braden Copper Co. has two hydro-electric stations rated at 20,860 kW, and there are a number of less important plants in various parts of the country.

A large project is to be undertaken by the recently-formed Cia. Electro-Siderurgica e Industrial de Valdivia. This is the harnessing of the Huilo Huilo Falls, which are stated to be capable of producing 120,000 h.p. The initial installation will be 30,000 h.p., and the cost of the power delivered at Valdivia (105 miles away) is estimated at 1 centavo (.05d.) per kWh.

Electric Railways and Tramways.

The electrification of the first zone of the Chilean State Railways, about 150 miles of route, at a cost of approximately £17,500,000, has now been completed. It comprises the sections from Santiago to Valparaiso *via* Llai Llai, and from the last point to Los Andes, connecting up with the Transandine Railway to Buenos Aires, *via* Mendoza. The necessary equipment included 39 locomotives and three substations. The electrification of the Transandine line between Los Andes and Mendoza, at a cost of £230,770, has been decided upon.

During the period under review deliveries have been made, under old contracts, of electric locomotives from the United States, and steel passenger cars from Germany. It is desired in future, as far as possible, to place orders for rolling stock with national factories. A large order for signalling material was placed with a British firm during 1924.

In October last the Government granted a concession to a local firm for the construction of an underground railway 9 km. long, at a depth of about 10 metres, through the centre of Santiago. The cost is estimated at £500,000, and the period of construction two years.

As regards tramways few new developments occurred during the period covered by the report. The Cia. de Electricidad de Valparaiso, mentioned above, recently purchased 21 new Belgian cars for the Valparaiso-Viña del Mar route, and considerable improvements have been made in the city service.

Until quite recently horse-tramcars were in use in Iquique, but these have now been supplanted by motor-tramcars, which, together with the opening up of new routes, has led to a great improvement. A new company is being formed under the name of Cia. del Ferro-Carril Urbano y Traccion de Iquique, with a capital of $180,000 gold. At the date of the report there were 19 cars running, but the number is being increased to 25.

Telegraphy and Telephony.

In 1924 the State telegraph authorities purchased four Siemens high-speed telegraph transmitters and receivers at a cost of £11,250; these have been installed at Santiago, Valparaiso, Antofagasta, and Iquique. When funds are available all the principal offices will be supplied with similar apparatus. The Government has authorised increases in the cable rates to counteract the effect of the depreciation of the peso. It was hoped to inaugurate the Italian cable, which had been in process of laying for some time, in November last, for the portion connecting with North America, and this year the portion to Buenos Aires is to be completed.

At present there are four large telephone companies operating in Chile, the Chile Telephone Co., Ltd., the Cia. Nacional de Telefonos, the Cia. de Telefonos de Bio Bio, and the Cia. Nacional de Telefonos de Valdivia, as well as a number of smaller concerns. A company with a larger capital than all the others combined is being formed. This is the Cia. de Telefonos y Servicios Electricos, with a capital of 30 million pesos. The Chile Telephone Co.'s concession expired some years ago, and it had been working without any concession until 1924, when it was renewed upon the understanding that the company must install the automatic system in Santiago within a period of three years, and construct new trunk lines between the capital and Valparaiso, Talcahuano, San Antonio, San Felipe, and Los Andes. The capital of the company must be nationalised to the extent of 40 per cent., and 80 per cent. of the staff must be Chilean.

Radio Communication and Broadcasting.

Radio communication in Chile is controlled by the Navy, but no laws exist. The following naval stations are in operation:—Arica, Coquimbo, Valparaiso, Juan Fernandez, Llanquihue, and Punta Arenas. Several subsidiary stations also exist, but do not work regularly. Marconi equipment is installed in all stations, except those at Valparaiso and Talcahuano, where Telefunken apparatus is used. A station was in process of erection at Antofagasta at the date of the report; the work was being carried out by the British Marconi Co. on behalf of the Chilean Navy, but the station is intended for commercial use as well. It has been decided to erect a further station at the port of San Antonio. Naval purchases are generally made through the Naval Commission in London, and information in this connection is obtainable from the Chilean Legation.

Broadcasting has met with an enthusiastic reception in Chile, and it is stated that there are about 12,000 receiving sets in use, half of which are in Santiago. The principal broadcasting company is the Cia. Radio Chilena de Santiago, which was formed in June last. The company broadcasts practically all day and night, and recently installed more powerful apparatus than that used by its predecessor, the Cia. Radio Chilena. The company holds a Government concession for a term of 30 years to install and operate transmitting and receiving stations to be equipped exclusively for dealing with foreign messages. There is reason to believe that the market for radio apparatus will steadily increase. At the present time estimates show that supplies come from the following countries in the proportions shown:—United States, 75 per cent.; Germany, 12 per cent.; United Kingdom, 9 per cent.; and France, 4 per cent. The cheapest set will always be given preference, and British manufacturers should adapt themselves closely to local requirements.

Methods of Business.

Many people commence business with Chile under false impressions. In the past, Chile was not a manufacturing country, but it is fast becoming one; in the past, also, the trade of the country was done exclusively by foreigners, but the Chilean is now taking a personal interest in business, and has become a factor to be reckoned with. Personal contact only can give the knowledge requisite before trade is commenced, and suitable representatives must be sent out before a sound and remunerative connection can be built up. The fact that goods are "Made in England" is not sufficient to make the public prefer them to others; they must pass the test in competition with similar goods from other countries. Among the points which must be observed if it is desired to increase business are:—Regular visits by representatives; systematic circulation of catalogues printed in Spanish; continuous study of the market and adaptation to it; full co-operation with the local agent, whose suggestions and advice should be followed where practicable; and the adoption of the metric system for all weights and measures. There have been complaints that British manufacturers do not observe these rules, and that their representatives are often unsuitable, both from the points of view of language and technical knowledge. In addition, the report says that more money must be spent on advertising where the local agent considers this necessary.

Swiss Electrical Trade Statistics.

The following statistics, showing the import and export trade of Switzerland in electrical and allied goods in 1924 have been taken from the recently-issued official trade returns. The figures for 1923 have also been given, and notes added of any increases or decreases. The returns show the most important but not all the countries of origin or destination of the goods. An asterisk has been placed where the absence of a figure means not necessarily that there has been no trade but that it has been of comparatively slight importance in the year indicated; in such cases the precise increase or decrease cannot be given.

Imports.

	1923. Fr.	1924. Fr.	Inc. or dec. Fr.
Electrical cable, not insulated—			
Total	42,000	77,000	+ 35,000
From Germany	38,000	50,000	+ 22,000
„ France	6,000	24,000	+ 18,000
Insulated cable not lead covered or iron armoured—			
Total	146,000	217,000	+ 71,000
From Germany	28,000	95,000	+ 67,000
„ France	11,000	17,000	+ 6,000
„ Italy	5,000	20,000	+ 15,000
„ Belgium	73,000	68,000	- 5,000
„ Holland	28,000	—	- 28,000
Cable covered with lead—			
Total	37,000	117,000	+ 80,000
From Germany	2,000	8,000	+ 6,000
„ Italy	6,000	107,000	+ 101,000
Cable covered with lead and iron armoured—			
Total	34,000	21,000	- 13,000
From Germany	30,000	17,000	- 13,000
„ Italy	*	4,000	—
„ France	3,000	—	- 3,000
Cable insulated with rubber or paper and covered with textiles—			
Total	311,000	619,000	+ 308,000
From Germany	40,000	110,000	+ 70,000
„ Italy	20,000	49,000	+ 29,000
„ France	27,000	26,000	- 1,000
„ Belgium	179,000	168,000	- 11,000
„ Holland	36,000	190,000	+ 154,000
Cable ditto covered with lead—			
Total	228,000	1,194,000	+ 966,000
From Germany	39,000	1,103,000	+1,064,000
„ Belgium	30,000	36,000	+ 6,000
„ Italy	133,000	2,000	- 131,000
„ Great Britain	—	34,000	+ 34,000
Dynamo-electric machines and electric transformers—			
Total	1,615,000	2,820,000	+1,205,000
From Germany	1,089,000	1,088,000	- 1,000
„ France	101,000	198,000	+ 97,000
„ Italy	11,000	32,000	+ 21,000
„ United Kingdom	364,000	1,228,000	+ 864,000
„ United States	33,000	179,000	+ 146,000
Accumulators, batteries, electrodes in combination with rubber or celluloid—			
Total	979,000	1,252,000	+ 273,000
From Germany	479,000	558,000	+ 79,000
„ Italy	70,000	65,000	- 5,000
„ France	206,000	322,000	+ 116,000
„ United States	42,000	113,000	+ 71,000
„ Austria	100,000	69,000	- 31,000
„ United Kingdom	37,000	104,000	+ 67,000
Accumulators, &c. (other)—			
Total	94,000	166,000	+ 72,000
From Germany	56,000	57,000	+ 1,000
„ France	22,000	45,000	+ 23,000
Electric locomotives—			
Total	170,000†	—	- 170,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	403,000	499,000	+ 96,000
From Germany	339,000	266,000	- 73,000
„ United Kingdom	*	90,000	—
„ France	11,000	39,000	+ 28,000
„ United States	*	81,000	—
Electric arc lamps—			
Total	71,000	30,000	- 41,000
From Germany	70,000	29,000	- 41,000
Electric incandescent lamps, mounted—			
Total	2,066,000	2,241,000	+ 175,000
From Germany	339,000	381,000	+ 42,000
„ Austria	118,000	132,000	+ 14,000
„ Holland	1,480,000	1,488,000	+ 8,000
„ France	35,000	76,000	+ 41,000
„ Hungary	*	134,000	—
Insulators, mounted—			
Total	91,000	409,000	+ 318,000
From Germany	67,000	180,000	+ 113,000
„ United States	*	80,000	—
„ Denmark	*	137,000	—
Electric meters—			
Total	297,000	500,000	+ 203,000
From Germany	258,000	445,000	+ 187,000
„ France	23,000	30,000	+ 7,000
Telegraph and telephone apparatus—			
Total	2,373,000	3,220,000	+ 847,000
From Germany	786,000	1,916,000	+1,130,000
„ United Kingdom	200,000	334,000	+ 134,000
„ Sweden	45,000	149,000	+ 104,000
„ France	257,000	402,000	+ 145,000
„ Belgium	1,072,000	332,000	- 740,000
Electrical apparatus not elsewhere mentioned—			
Total	1,670,000	2,471,000	+ 801,000
From Germany	1,018,000	1,436,000	+ 418,000
„ France	113,000	167,000	+ 54,000
„ United Kingdom	476,000	599,000	+ 123,000
„ United States	38,000	56,000	+ 18,000

† All from Germany.

Exports.

	1923. Fr.	1924. Fr.	Inc. or dec. Fr.
Dynamo-electric machines and electric transformers of all kinds—			
Total	23,548,000	24,159,000	+1,611,000
To Germany	239,000	450,000	+ 211,000
„ Austria	93,000	279,000	+ 186,000
„ France	2,996,000	3,741,000	+ 745,000
„ Italy	846,000	523,000	- 323,000
„ Belgium	1,427,000	1,964,000	+ 537,000
„ United Kingdom	1,552,000	1,940,000	+ 388,000
„ Egypt	492,000	406,000	- 86,000
„ Spain	4,740,000	2,961,000	-1,779,000
„ British India	58,000	152,000	+ 94,000
„ Poland	485,000	878,000	+ 393,000
„ Rumania	476,000	149,000	- 327,000
„ Colombia	259,000	*	—
„ Brazil	490,000	593,000	+ 103,000
„ Argentina	900,000	669,000	- 231,000
„ Netherlands	719,000	1,121,000	+ 402,000
„ Norway	1,136,000	1,485,000	+ 349,000
„ Netherlands Indies	214,000	172,000	- 42,000
„ China	669,000	541,000	- 128,000
„ Japan	2,170,000	2,061,000	- 109,000
„ Peru	495,000	665,000	+ 170,000
Accumulator batteries, electrodes in combination with rubber or celluloid—			
Total	125,000	184,000	+ 59,000
To France	2,000	68,000	+ 66,000
„ Italy	3,000	57,000	+ 54,000
„ United Kingdom	44,000	—	- 44,000
„ Poland	59,000	*	—
Accumulators, &c. (other)—			
Total	74,000	59,000	- 15,000
To France	32,000	10,000	- 22,000
„ Italy	11,000	1,000	- 10,000
„ United Kingdom	*	17,000	—
Insulators, mounted—			
Total	250,000	198,000	- 52,000
To Germany	39,000	25,000	- 14,000
„ France	46,000	19,000	- 27,000
„ Italy	85,000	73,000	- 12,000
„ Spain	*	51,000	—
„ United Kingdom	55,000	*	—
Electric cable not insulated—			
Total	1,189,000	1,432,000	+ 243,000
To France	270,000	278,000	+ 8,000
„ Austria	*	137,000	—
„ Italy	—	83,000	+ 83,000
„ United Kingdom	471,000	705,000	+ 234,000
„ Norway	—	24,000	+ 24,000
„ Jugo-Slavia	398,000	138,000	- 260,000
Insulated cable not lead covered or iron armoured—			
Total	1,157,000	1,311,000	+ 154,000
To France	86,000	31,000	- 55,000
„ United Kingdom	837,000	960,000	+ 123,000
„ Denmark	—	75,000	+ 75,000
„ Austria	15,000	40,000	+ 25,000
„ Sweden	—	22,000	+ 22,000
„ Hungary	—	42,000	+ 42,000
„ Egypt	20,000	*	—
„ Peru	*	37,000	—
Cable, lead covered—			
Total	101,000	52,000	- 49,000
To Greece	52,000	—	- 52,000
„ Rumania	*	49,000	—

	1923. Fr.	1924. Fr.	Inc. or dec. Fr.
Cable, lead-covered and iron armoured—			
Total	321,000	84,000	– 237,000
To Rumania	196,000	68,000	– 128,000
,, France	*	1,000	—
,, Jugo-Slavia	36,000	*	—
,, Argentina	43,000	*	—
Cable, insulated with rubber or paper and covered with textiles—			
Total	50,000	151,000	+ 101,000
To France	41,000	35,000	– 6,000
,, Belgium	*	54,000	—
Electric locomotives—			
Total	1,082,000	3,935,000	+2,853,000
To Dutch East Indies ...	*	640,000	—
,, United Kingdom ...	188,000	*	—
,, South Africa	*	3,037,000	—
,, Spain	235,000	—	– 235,000
,, Japan	643,000	237,000	– 406,000
Telegraph and telephone apparatus—			
Total	175,000	481,000	+ 306,000
To France	29,000	51,000	+ 22,000
,, Italy	4,000	8,000	+ 4,000
,, Germany	*	63,000	—
,, Spain	*	30,000	—
,, Dutch East Indies ...	*	121,000	—
,, Greece	74,000	*	—
,, United Kingdom ...	25,000	80,000	+ 55,000
Electric incandescent lamps, unmounted—			
Total	—	31,000	+ 31,000
To France	—	31,000	+ 31,000
Electric incandescent lamps, mounted—			
Total	3,508,000	2,276,000	– 1,232,000
To Austria	10,000	15,000	+ 5,000
,, France	850,000	725,000	– 125,000
,, Italy	1,928,000	1,277,000	– 651,000
,, Portugal	48,000	—	– 48,000
,, Germany	*	19,000	—
,, Norway	261,000	64,000	– 197,000
,, Algeria	61,000	*	—
,, Canada	80,000	*	—
,, Australia	40,000	*	—
,, United Kingdom ...	69,000	32,000	– 37,000
Electric meters—			
Total	10,280,000	10,190,000	– 90,000
To Germany	22,000	164,000	+ 142,000
,, Austria	119,000	285,000	+ 166,000
,, France	2,711,000	2,385,000	– 326,000
,, Italy	652,000	813,000	+ 161,000
,, United Kingdom ...	727,000	783,000	+ 56,000
,, Belgium	1,157,000	1,031,000	– 126,000
,, Spain	751,000	905,000	+ 154,000
,, Japan	1,560,000	1,325,000	– 235,000
,, Netherlands	153,000	143,000	– 10,000
,, Czecho-Slovakia ...	616,000	286,000	– 330,000
,, Australia	837,000	759,000	– 78,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	14,226,000	15,117,000	+ 891,000
To Germany	371,000	284,000	– 87,000
,, France	1,941,000	1,816,000	– 125,000
,, Belgium	2,167,000	3,470,000	+1,303,000
,, Holland	375,000	955,000	+ 580,000
,, British India	46,000	56,000	+ 10,000
,, Japan	2,395,000	2,391,000	– 4,000
,, United Kingdom ...	1,647,000	2,860,000	+1,213,000
,, Spain	1,151,000	258,000	– 893,000
,, China	899,000	219,000	– 680,000
,, Argentina	1,119,000	332,000	– 787,000
,, Egypt	422,000	2,420,000	+1,998,000
,, Rumania	191,000	91,000	– 100,000
,, Russia	681,000	103,000	– 578,000
,, Portugal	*	40,000	—
,, Colombia, Chile, &c. ...	75,000	323,000	+ 248,000
Electrical apparatus not elsewhere mentioned—			
Total	9,104,000	9,333,000	+ 229,000
To Germany	99,000	141,000	+ 42,000
,, Austria	98,000	183,000	+ 85,000
,, France	2,096,000	1,887,000	– 209,000
,, Italy	423,000	418,000	– 5,000
,, Belgium	1,998,000	1,650,000	– 348,000
,, Netherlands	309,000	365,000	+ 56,000
,, United Kingdom ...	686,000	396,000	– 290,000
,, Spain	1,242,000	1,171,000	– 71,000
,, Portugal	126,000	154,000	+ 28,000
,, Norway	132,000	90,000	– 42,000
,, Czecho-Slovakia ...	229,000	373,000	+ 144,000
,, Egypt	177,000	185,000	+ 8,000
,, China	170,000	187,000	+ 17,000
,, Japan	164,000	315,000	+ 151,000
,, United States	251,000	431,000	+ 180,000
,, Argentina	119,000	96,000	– 23,000
,, Peru	98,000	310,000	+ 212,000
,, Rumania	*	130,000	—
,, Poland	*	168,000	—

Insulating Problems in High-Voltage Engineering.

Abstract of I.E.E. Informal Discussion.

At the informal meeting of the Institution of Electrical Engineers, on April 6th, Lieut.-Col. K. Edgcumbe was in the chair, when Mr. A. Collins opened a discussion on the above subject, remarking that British manufacturers had, during the last few years, been handling voltages much higher than was generally realised. Appreciable quantities of switchgear and transformers had been built for working pressures of 110,000 volts. Gear for 132,000 volts was under construction, and many large testing transformers had been built, the largest of which to date had a rated capacity of 400 kVA, and a maximum working pressure of 500,000 V.

Absorbent materials of the press-board class were being used under oil in transformer construction, but the most widely used material—particularly for switchgear construction—was that which the B.E.A.I.R.A. called "Varnish Paper," its trade names being American "Micarta," British "Paxolin," Swiss "Haefelite," and various others.

The insulation between the high- and low-pressure windings of a transformer was an example of dielectrics in series. The almost universal practice was to use one or more tubes of fibrous insulating material and, by means of suitable packing pieces, to provide for complete circulation of the oil between the windings. Bakelite varnish-paper cylinders were largely used, particularly below 50,000 volts, but for the higher voltages there was a growing tendency to use specially manufactured high-grade press-board in place of such cylinders. The desirability of providing high mechanical strength and moisture-resisting properties had so far prevented the electric strength of varnish-paper cylinders at 90 deg. C., exceeding a one-minute value of from about 350 to 400 volts per mil. By way of comparison, the press-board policy led to a cheaper scheme, because, instead of being manufactured in expensive tubes, it was applied in sheet form in a series of thin layers. Convenience of assembly was a strong point in favour of Bakelite cylinders, at least for voltages below about 50,000.

High-voltage bushings and terminals of all classes lent themselves admirably to the varnish-paper process of manufacture. Ionisation between conductor and insulation was eliminated by winding the insulation direct on to the conductor. At 11,000 volts and upwards this practice should be strictly followed, instead of slipping the insulating tube over the conductor. With a plain tubular or bulk type insulator, discharges across axial clearances was a direct consequence of the unfavourable conditions in the vicinity of the clamp.

In air this discharge became evident as corona at somewhere about 10 kV; in oil it might commence at somewhere about 30 kV. With the bulk type construction such a discharge was to a large extent independent of the proportions of the insulator. The remedy was the condenser type construction, whereby the pressure at which the discharge commenced could be maintained well above the working pressure. In addition, shorter clearances could be employed with safety, and flash-overs maintained at a figure commercially impossible with bulk type construction.

It was accepted practice to study electric strength by means of time-voltage curves in terms of thickness and temperature, but the difficulty was that discharge from the edge of the outer electrode rendered the determination of the true radial breakdown impossible. Such a test, however, had its practical value as a basis of comparison, particularly as the electrode conditions were more severe than would be expected in practice. Experience indicated the desirability of limiting the value of the high-pressure test, or the insulation might be damaged by the internal heating which was known to precede breakdown, and also by the discharge from the edge of the electrode. The latter might actually permanently mark the insulation, even after a one-minute application.

The extent of the damage was dependent upon the time of application, and relatively high pressure could be applied for a short time with safety. Mr. Collins recommended that the one-minute high-pressure test should correspond to a stress of approximately half the one-minute breakdown value. Such a test could be applied several times, if necessary, under commercial conditions without any risk of damage, and an insulating system designed on that basis would have a reasonable factor of safety capable of meeting the abnormal conditions which might arise in service.

Experience showed that insulators designed and tested purely upon one-minute figures might prove unsatisfactory under operating conditions; the material, design, and workmanship all contributed to the ultimate performance. For this reason it had become the practice to subject high-voltage insulators to more conclusive type tests, using the one-minute test merely as a convenient commercial check test, and a considerable amount of research was now being devoted to suitable methods of testing.

Abnormally high pressures on a system were of short duration, so that a flashover type test might be made by raising the voltage comparatively rapidly until flashover occurred. Radial efficiency could only be checked by the long application of a voltage of the order of from 25 to 50 per cent. above normal between-phase pressure, the test being carried out at maximum permissible working temperature. There has been a tendency in the past to over-rate the importance of a one-

minute test, and to suggest a false sense of security by raising this value relative to the breakdown value. Merely raising the pressure test on a given design did *not* alter the factor of safety in *any* way and might only lead to damage in testing.

The method was based upon the knowledge that an insulator remained in a healthy condition so long as the heat developed could be dissipated at a rate which would eventually ensure steady conditions. When the voltage exceeded a limiting figure, the temperature would begin to rise rapidly and the insulator would eventually break down. The difficulty was to observe in a simple way some property which was a sensitive indication of the condition of the insulator. Observations of temperature were difficult, unreliable, and not always possible.

Mr. Collins exhibited excellent samples of different materials and a number of lantern slides showing the application of the materials and their behaviour under stresses.

Lieut.-Col. Maxwell, and Messrs. H. C. Silver, P. Dunsheath, A. Berkeley, Dunton, W. A. Erlebach, K. Edgcumbe, R. T. Fleming, S. Messent, H. F. Quinton, E. S. Ritter, and J. F. Shipley, took part in the subsequent discussion.

Electricity Supply Tariffs.

Discussion at the Institution of Electrical Engineers.

The last meeting of the Institution of Electrical Engineers was devoted to a general discussion on the above subject, which was introduced by two short papers which are abstracted below. Mr. H. M. Sayers tackled the matter in an analytical manner, while Mr. G. Wilkinson, as was pointed out in the discussion, approached it in his characteristic way of, first, inventing an ingenious device and then writing a paper in order to show how the apparatus could be usefully employed. Mr. Wilkinson exhibited two electricity meters, one by Measurement, Ltd., and the other by Chamberlain & Hookham, Ltd., which had been modified so as to incorporate the "discriminator" described in his paper. Their conversion had been carried out by a Faraday House student.

Electricity Supply Tariffs.

By H. M. Sayers, M.I.E.E.—*Abstract.*

The paper deals with tariffs for domestic supply and its object is to show that the present heavy ratio of distribution to generation costs can be materially improved by improving the distribution load factor, especially by improving it all over any supply area; that it is necessary to keep control of distribution economy by measurement, and to apply the known principles of economic design to distribution networks, and that tariffs recognising load and diversity factors of domestic consumers by classes are practicable and will attract the most desirable domestic load, thereby improving the utilisation of distribution systems and permitting progressive reduction in supply charges. It is assumed that a rational and practicable basis of charging is:—Cost, plus a reasonable return on the capital employed.

Distribution costs are very heavy; their reduction requires more attention than it has received. "Copper cost" of distribution is largely (and generating cost somewhat) dependent upon the form factor (shape of load diagram), as well as upon the load factor of each section of a distribution system. This and other distribution costs do not follow the same laws as the costs of generation in respect of load factor and form factor. The cost of "units unaccounted for" increases at each step; it is necessary to measure them, and to take steps to reduce them to a minimum. Good load factor in one section does not compensate for poor load factor in another.

The practical application of the method which the author suggests for arriving at tariffs for domestic supply is, first, to classify consumers by their load and diversity factors. The best basis for this is observation of selected groups with similar proportions of connected load for different uses. Something of this kind has already been published, for example, Mr. W. A. Gillott's paper on "Domestic Load Building"* showed that in a homogeneous group of consumers using cooking apparatus the diversity factor was about 9, so that the kW charge to them would be properly one-ninth of the individual maxima. He also showed that this charge would be fairly well represented by charging the lighting rate for their lighting consumption, and a much lower rate for the rest.

There are many tariffs in use all endeavouring to fix a basis which represents a kW charge. Very generally the underlying notion is that lighting is the measure of the peak load to be charged for on the kW rate for domestic supplies. This notion may be generally correct at present, but the author suggests that the domestic lighting load will become of diminishing importance as "other uses" become generalised. Many of the two-part domestic tariffs referred to above are difficult to justify on any logical ground; and smaller householders are repelled by an obligation to make relatively large fixed periodic payments. Tariffs which permit the use of prepayment meters are indispensable to the generalisation of domestic electrification.

As there will be for a long time to come—perhaps always—considerable difference between the load characteristics of domestic consumers living in the same districts, it will not be correct to use the minimum rates worked out on the hypothesis of homogeneous groups on each distributor. The actual rates will have to be higher than these minima, because each class, scattered over the supply area and mixed up, will not be the equivalent of a single consumer.

The practical method of classification can be worked out only for each supply area, because local habits and customs, prevailing industries, &c., will have their effects on the load characteristics. The general method, the author suggests, should be to ascertain the load characteristics of consumers with various proportions of lighting, cooking, heating, motor, &c., appliances, and from these observations define the classes and fix the rates.

Some things must be averaged. It is not practicable or legal to make differential charges depending upon the distance of consumers from the generating or bulk-supply source, so that an average distance and cost must be taken. There is the legal prohibition of "preference" to be observed; hence different flat rates must be based upon defensible differences in circumstances.

For the immediate future it may be advisable to limit the maximum lighting demands of domestic consumers under these tariffs. Generally, in small houses the lighting circuit is bound to be separate from the cooking, heating, &c., circuits, so that the use of current limiters is feasible. One attractive proposition is to connect the lighting to the circuit supplying a heat-storage tank, with a limiting switch to turn off the heater as soon as more than one or two lamps are in use. This would give the lighting part of a load a 100 per cent. load factor.†

Tariff Simplification by Discrimination.

By G. Wilkinson, M.I.E.E., and R. McCourt.—*Abstract.*

In the fourth annual report of the Electricity Commissioners reference is made to the rateable-value system of charging for electricity, the limitations of that form of tariff, and its unsuitability for general application. The authors, submit, therefore, that while a two-part tariff is the best for stimulating the increased use of electricity, the fixed charge should be based on the electrical requirements of the consumer in watts or kilowatts, and on this alone.

The authors claim that they have devised a system and designed a simple and reliable instrument by which substantial advantages can be obtained and an accruing growth of business secured. Briefly the *modus operandi* is as follows: The consumer, instead of having to wait until the end of the quarter or half-year to learn the amount of his more or less variable demand, with the assistance of the supply undertaking assesses himself to take a fixed number of watts as a normal maximum of his requirements, and for this demand he pays a fixed quarterly charge per kilowatt demanded at 8d. per unit, according to his classification. A two-rate meter is installed, on one dial of which all the current used under normal conditions, including the *pro rata* number of units at 8d., are recorded; after this deduction the residue is charged at the low price per unit. Should he exceed the pre-arranged demand the "discriminator" mechanism automatically transfers the record of current consumed to the second dial, the units registered on that dial being charged for at a higher rate. It follows that a consumer will use every means not to exceed his agreed demand, while at the same time he will endeavour to keep his demand as high as possible within the low-rate supply limit, thus giving the supply authority a much better load curve.

To assist the consumer and give him visible indication when he is exceeding his declared maximum demand a neon lamp may be illuminated through the action of the "discriminator" changing the record.

The "discriminator" consists of a small coil in series with the main circuit of the meter; within the solenoid is a light iron core or its equivalent shackled to the rocking bar operating either one or other of the dials referred to, according to its position. Normally, by reason of its own weight or otherwise, the rocking bar maintains the recording gear in circuit with the "low-rate" dial, but, should the load at any time exceed the amount contracted for, the increased current in the series coil is strong enough to rock the bar, thereby disconnecting the "low-rate" dial train and bringing into use the train operating the "high-rate" dial, upon which the consumption is then recorded until the load is reduced to within the limits of the contract, when its record is automatically restored to the "low-rate" dial. The units recorded on the "high-rate" dial are charged for at a price sufficiently high to deter the consumer from exceeding the terms of his contract.

In a uniform tariff meter of this character it is of the utmost importance to obtain simplicity and cheapness, together with

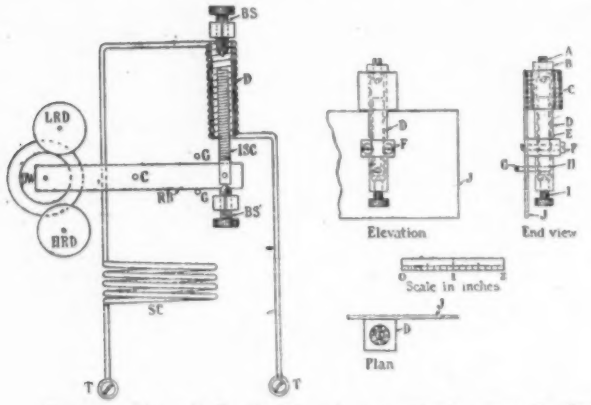
* Elec. Rev., December 8th, 1922.

† Elec. Rev., June 2nd, 1922; p. 774.

entire reliability of operation. Figs. 1 and 2 show how these features are secured. The change-over is prompt and accurate without danger of the operating gear taking a neutral position clear of both recording mechanisms. This is achieved by the adjustable magnetic brakes at the top and bottom, in the form of steel screws set to positions which, in the one case, restrain the iron core from being lifted by the solenoid until the maximum load contracted for is exceeded, when the current in the solenoid is able to overcome the magnetic brake; thus there is ample stored energy in the movable element to carry the gear promptly and definitely into train with the "high rate" dial.

The uniform-tariff meter as described is simpler and contains fewer parts than the ordinary two-rate meter, and no time clock whatever is necessary in connection therewith; also it is much less expensive and complicated than a maximum-demand tariff.

The authors are of opinion that the fixed-charge part of the tariff should be built up on the basis of a quarterly charge at, say, 8d. per unit for a definite number of units per kW of demand, according to classification, and all over this number



SC, meter series coil; D, discriminator; ISC, iron spiral coil with solid end; BS, BS', adjustable magnetic screws; RB, rocking bar carrying driving wheel DW; LRD, low-rate dial train wheel; HRD, high-rate dial train wheel; C, rocking bar turning centre; T, T', meter terminals; G, G, rocking bar stops.

Fig. 1.—Uniform Tariff Meter, A.C. Type.

A, top magnetic screw; B, bush carrying screw A; C, operating coil; D, carrier of insulating material; E, magnetic core; F, fixing screws; G, pin operating rocking bar; H, hole in core engaging pin G; I, bottom magnetic screw; J, back plate of counter gear frame.

Fig. 2.—Fitment in Meter.

registered on the "low rate" dial to be charged for at, say, 1d., ½d., or ¼d. per unit according to the size of the undertaking and the local conditions under which the supply is furnished, all the units registered on the "high rate" dial to be charged for at, say, 6d. per unit. The charts in the paper show that the consumer is encouraged to make long-hour use of his agreed demand without exceeding it.

Under ordinary conditions equity calls for the division of the consumers into at least three classes, *viz.*, factory and workshop, business, and domestic. In the case of lighting in factories and workshops the diversity factor may seldom be more than unity, but in the case of domestic supply it is almost certain to be frequently more than 2; in the case of power in a factory it may be less than 2, but in business premises it is likely to be more than 2. In the case of a present-day factory or workshop the amount of electric heating, which includes cooking, is so small that it may be neglected, while among the domestic consumers it is now fairly well established, and confirmed in Mr. S. C. Hurry's recent paper before the British Electrical Development Association, which summarises the replies from 20 public supply engineers, that the cooking load has a diversity factor of from 9 to 10. Thus, the figure of 9 which we have taken is justified. By arranging the various uses of the different consumers we arrive at an average diversity factor of 2.5.

Diversity factor is, however, not the only consideration in framing a tariff, as the load factor is very important from the supplier's point of view. A tariff such as that advocated by the authors will give the strongest possible incentive to the consumers to increase their hours of use and decrease their maximum demand on the supply station.

Discussion in London.

Lt.-Col. W. A. Vignoles, D.S.O., opened the discussion by saying that they already had several "factors" and the authors now proposed to have another—the form factor—but they did not seem to get any further. Why were they there that night? Surely most supply undertakings had already adopted a policy. There was no need to invent further tariffs; they must get down to the business of selling electricity. Were the papers really going to help them? The Sayers method of classification was not practicable for use by the salesman. His facts were sound, but they must devise some rough method of averaging the cost. Wright's method was not understood by the consumer, and the authors proposed to still further complicate matters; they could not afford to have special meters and change the thousands of existing ones. Moreover, the consumer would not get the benefit of the diversity factor between others. They must have a one meter tariff. The only practical tariff was the plain 2-part one, with a fixed charge per year, plus 1d. per kWh. That had proved to be successful, and he was certain that they would all adopt it sooner or later. It was difficult for a Government Department to make anything compulsory, but the Commissioners' Committee which proposed to fix the first charge would, if it tackled the matter properly, solve their difficulty. He maintained that the tariff problem was settled, and that now they must get down to the business of selling electricity by the same means used for selling other commodities.

Capt. J. M. Donaldson, M.C., remarked that the previous speaker had said nearly all he himself had wished to say. The flat rate had been very unfair in the past. Mr. Sayers proposed that some unfortunate individual should make a selection; he would not like to be that individual. The maximum demand system was hopeless for domestic purposes. Mr. Wilkinson made a horrible proposition in suggesting putting batteries in consumers' premises. They must have a 2-part tariff, so that they could plug almost any apparatus on to the lighting mains which would take them; excepting certain larger devices, there were many things that could be so used. The fixed rate should be based, if possible, on the lighting, and they must be able to tell people what it would cost them to use certain devices; that could be done.

Mr. J. R. Blaikie said that Mr. Sayers had done good service in emphasising the importance of the cost of mains, but his figures were rather high. The value of tariffs was very great, but the mistake made in most papers was that the method of arriving at the running and stand-by costs was not explained. Dr. Hopkinson had set out to beat gas, and he had done so by tariffs. The maximum demand system had been a failure.

Mr. E. W. Cowan asked if they were certain that it would be an advantage to try to get the consumer not to exceed a certain demand. It would be profitable to do so only when the main was fully loaded, but that circumstance only occurred for very short periods. It was only then that they should be prevented from doing so; could the device mentioned in one of the papers be modified to do that?—preferably by means of a critical pressure change over, but it was difficult to design a suitable coil for the purpose. He did not agree that the principle laid down at the beginning of both papers was correct or equitable. Dr. Hopkinson had used such terms as "some relation" showing that he was very careful and appreciated discrimination. The price of a public service should be influenced both by the cost and value of that service.

Mr. J. W. Beauchamp pointed out that there were other types of supply besides domestic, and Mr. Wilkinson's ingenious device would undoubtedly be found useful in some of them. He emphasised the fact that those who sold electricity too cheaply were doing just as much, if not more, harm to the industry as those who sold it too dearly. The cost of supply to the consumer could not be fixed, because the cost varied from day to day as the next door premises increased or decreased its use of apparatus. Therefore, they must not deal with individuals, but with areas. He agreed with the remarks that had been made concerning service, and they must have a multi-part tariff. They had not yet found a fixed charge method to eliminate all the objections. The days of the limiter were passed. Mr. Wilkinson did not propose to "bob the light, but the consumer's pocket." Occasionally analytical papers of this sort were useful. They must go out and sell with the simplest tariff, offering medium priced light and power, but competitive prices for heating.

Mr. R. O. Kapp said that the line of investigation suggested by Mr. Sayers was very important, and it should be understood what the figures so arrived at did really mean. A little more Shylock would probably be advantageous to all concerned. It was unreasonable to expect business to be done without a reasonable amount of profit.

Mr. F. W. Purse pointed out that Mr. Wilkinson did not discriminate between times of high and low load. There always would be a bump in the load curve which they would have to contend with. Would it be possible to use some means of sending a high-frequency pulse over the mains in order to make the change over? Mr. Sayers did well to call attention to the four different kinds of consumer. The cost of the kWh sent out was the only fair basis, and he had used it himself for many years. He would be very sorry to have to classify the consumers in his district. Was not everything in business averaged? He did not agree that all manner of apparatus should be connected to the lighting mains. There should be two separate circuits, which would involve only a small difference in cost, and one meter could be used, if desired. The snag was not in the tariff, but the initial cost of the installation. People did not relish wiring someone else's house, but he hoped to overcome that difficulty by an Act of Parliament which would transfer that charge to the next tenant. A two-part tariff should be based on the watts installed.

Mr. Frank Gill pointed out that the analysis of costs did not determine the tariff. In the telephone industry the load and the use of the instrument were studied; then schedules of rates were made and examined to see if they would produce enough money to run the business. Next, schedules were criticised in order to eliminate those that were not simple, attractive, reasonable, &c. Thus, they were left with one or two which were workable.

Mr. P. Rosling, who spoke as a consumer, agreed that the lighting and cooking circuits should be separate. As to the

use of two meters, the cost could be overcome in more ways than one.

MR. G. WILKINSON, in reply, said the fact had been lost sight of that the electricity supply business was privileged, and therefore should not be conducted solely for profit. He was not legislating for to-day, because even in the highly developed districts they had hardly touched the fringe of what would be done in the future. They should not make a loss on one consumer and profit on another. When the public did appreciate the facts, some engineers would have a hot time. He appreciated Mr. Cowan's criticism as being constructive.

MR. H. M. SAYERS, also in reply, asked if they were satisfied with a load factor of 25 per cent. Was nothing else to be done? The maximum demand system was good for lighting, but for that only. In domestic supply lighting was going to be quite insignificant, if the whole thing was tackled properly. He agreed with Mr. Beauchamp that they "must lay heavy copper and then go out and make full use of it." They could not assess the value of service, especially in domestic supply, and they must also not charge less than it cost to produce, plus a profit.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Wool Yarn Lubrication Bearing.

A new bearing has been put on the market by the CENTURY ELECTRIC CO., St. Louis, Mo., U.S.A. This bearing, which is designed for use on high speed motors, depends for its effectiveness on the use of a number of continuous strands of pure wool yarn introduced into the bearing housing and oil well in such a manner as to replace the present methods of carrying oil to the shaft surface. As illustrated in fig. 1, the continuous strands of wool are in direct contact with the shaft, being under the influence of a spring attached to the underside of the oil well cover. Due to the high absorption factor

Fig. 1.—Wool Yarn Lubrication Bearing.

Fig. 2.—The "S.A." Plug.

of wool yarn, a very large volume of lubricant is held and it is claimed that the wool yarn used in this bearing will hold sufficient oil in suspension to properly lubricate a small motor for at least one year, running 24 hours per day. Due to the strands of wool being continuous there is a constant supply of oil to the armature shaft, in virtue of the capillary action of the wool. It will be seen that an additional oil well provides a reserve of oil so that the maximum absorption of the wool is always maintained.

The "S.A." Universal Plug.

The "S.A." plug, made by MESSRS. SHINWELL, ALEXANDER and Co., 18, Billiter Street, E.C., is a convenient device for use with the two types of socket in most common use in this country—the bayonet pattern and the two-pin socket. Its principal novelty, however, lies in the provision of a protective cap, which can be screwed over the end of the plug that is not in use (fig. 2). The central portion of the body of the plug, which is made of a black fireproof insulating material, is slotted and the wires enter at the sides, sufficient slack wire being left to allow of its being swung over. Two sets of holes are provided to enable either 10-A or 5-A pins to be employed.

With intelligent use the device would appear to suit its purpose very well, but the careless user who fails to screw the cap over the pins when inserting the lampholder end may be taught not to omit this precaution in future.

Small Lighting Plant.

The illustration, fig. 3, is of the engine and dynamo of a small lighting plant now being put on the market by MESSRS. A. LYON & CO., 18, Billiter Street, E.C. The complete plant consists of a single cylinder, low speed horizontal paraffin engine, a small shunt-wound dynamo, a battery, and a suitable control panel. The plant is made in four standard sizes, the engine, dynamo, and battery sizes being, respectively, 1 h.p., 0.45 kW, and 75 Ah; 2½ h.p., 1.35 kW, and 100 Ah; 3½ h.p., 1.75 kW, and 140 Ah; and 6½ h.p., 3.75 kW, and 140 Ah. The plant can be supplied with or without the battery. With

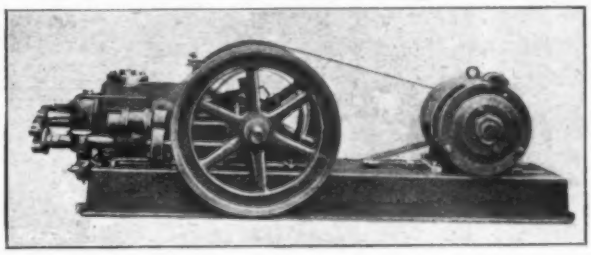


Fig. 3.—The Lyon Generating Set.

the exception of the largest size, in which the dynamo is provided with separate slide rails, the engine and dynamo are mounted on a box type bed. The engine is controlled by a throttle governor, and the ball-bearing crankshaft, gear-driven side shaft operating the valves and rotary h.p. magnets are important features. The dynamo is belt-driven from the engine. The makers claim very low running costs and the absence of bearing trouble often found in the case of vertical paraffin engines to be due to the paraffin leaking past the piston.

A New Suction Cleaner.

MESSRS. GILLESPIE & BEALES, of 12, Norfolk Street, Strand, have put a new, type "M," Nilfisk domestic suction cleaner on the market. The makers claim that the consumption of the cleaner does not exceed 100 watts; that it is suitable for a.c. or d.c. supply, and has a suction effect three or four times in excess of the usual types of cleaners, the suction being equivalent to 20 in. water gauge. It is 18½ in. high, weighs 9 lb., and has a bright aluminium finish. It is supplied complete with accessories, 22 ft. flexible cord, 6 ft. flexible hose, steel extension tubes, and four nozzles to suit all requirements. This type "M" Nilfisk cleaner has a great advantage in virtue of the ease with which it can be carried.

Portable Winch for Post Office.

The petrol-driven portable cable-hauling winch illustrated in fig. 4 has recently been designed and manufactured by MESSRS. LACY-HULBERT & CO., LTD., Pneumatic Engineers, Boreas Works, Beddington, Croydon, for H.M. Postmaster-General, who is using several in various parts of the country for "hauling in" new cables. It has many interesting and ingenious features about it, and is a revised and improved design of a machine invented about 15 years ago by the same firm for the same purpose.

The petrol engine, which is of 5 h.p., is arranged to run at a constant speed, the power being transmitted to the winch in the first instance by epicyclic gear, which is operated by a

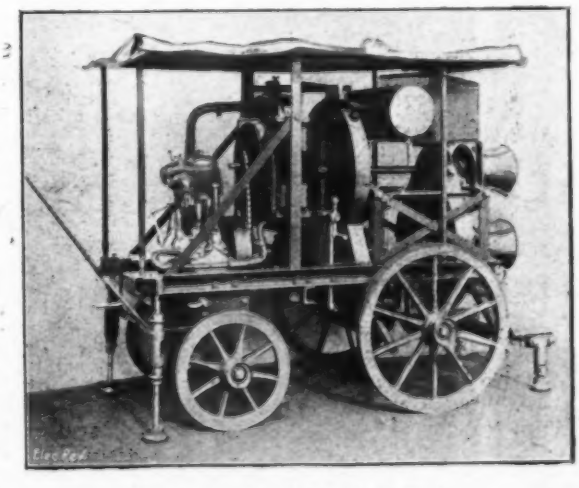


Fig. 4.—The Lacy-Hulbert Cable Winch.

drum controlled by brake shoes and a handle, visible in the illustration, forming a friction clutch safety device against any straining of the cable in the event of its becoming jammed in the conduit. Two hauling bollards are provided, the upper one running at a higher speed than the lower one, and the hauling

power of the winch, we are informed, is 2½ tons at a speed of 25 ft. per minute. Adjustable jacks are provided at each end of the machine to steady it when at work and also to take the downward thrust due to the hauling rope when working over a manhole.

The machine is provided with the necessary radiator and fan for cooling the engine; the petrol tank is large enough for a full day's run, and all parts appear to be very substantially and strongly made for the work they have to perform. The total weight of the machine is 12 cwt. It can be very readily hauled about on the wheels which are provided with springs and swivelling forecarriage.

An Overhead Line Tap.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 11, Holborn Viaduct, E.C.1, have placed on the market the clamp illustrated in fig. 5. It should prove an efficient means of making a quick mechanical connection or tapping to overhead lines. The brass forgings are provided with curved seatings for the segmental brass washers which present flat surfaces

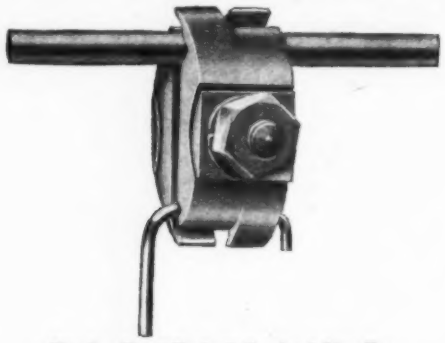


Fig. 5.—The "Henley" Overhead Line Tap.

for the nuts, regardless of the distance the jaws are apart. The two halves of the clamp are identical and small and large grooves are provided on each, so that by arranging the large grooves opposite each other a large wire may be gripped at one end and a small one at the other, or by reversing one half of the clamp two wires of equal size may be gripped.

Reversing Starter for Hoist Motor.

According to the *Electric Railway Journal*, a new reversing starter has been designed and put on the market by the GENERAL ELECTRIC CO., Schenectady, N.Y. This starter is intended particularly for monorail hoist service such as is common in electric railway shops.

It may be used with either a.c. or d.c. motors, and in operation throws the motor directly on the line. It consists of four single pole contactors mechanically interlocked and mounted on a suitable base and enclosed in a metal case for wall mounting. A push-button station is provided for operating the contactors, which are so arranged that the motor will run only as long as the push button remains depressed. The construction is so arranged that the cover may be locked shut if desired.

The "Memette" Switch Without Fuses.

This has been produced by the MIDLAND ELECTRIC MANUFACTURING CO., LTD. (M.E.M.), Barford Street, Birmingham. The original "Memette" combination switch and fuses was described and illustrated in these columns on October 3rd, 1924, and this latest production is the outcome of a demand for the same switch without fuses.

The switch is remarkably small, its dimensions being only 4¼ in. by 3¾ in. by 2¾in. for the standard 15 A, 250 V size. The mechanism is simple, and has a quick make and break. The makers claim compliance with the new I.E.E. rules and B.E.S.A. specification.

Legal.

Claim for Radio Apparatus Supplied.

AT the Southport County Court, on April 7th, a decision was given in the case in which the Lewis Electric Sedan Co., Southport, sued Miss B. A. Ashton, Birkdale, for £64, the price of a radio set supplied by the plaintiffs to the defendant (*vide* ELEC. REV., March 12th, p. 408). The defendant alleged that the set was not as ordered, that parts were supplied which she did not order, and that other parts were defective. A decision had been withheld in order that the parties might agree upon a wireless expert to examine the set and report to the Court. After hearing the expert's evidence, His Honour Judge THOMAS said he was satisfied that the set was supplied as ordered and installed in a correct manner. The fact that the defendant got unsatisfactory results was due to her inexperience and want of skill. It was a very unfortunate thing that defendant should take on an expensive installation of that kind which she was not able to work satisfactorily. He disallowed £2 19s. for one accumulator and gave judgment for the plaintiffs for £61 10s. with costs.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

23,571. "Electric signs or advertisements." Strand Electric & Engineering Co., Ltd. (M. Norden). September 20th, 1923. (230,874.)

24,996. "Speech-frequency translating systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). October 8th, 1923. (230,878.)

31,337. "Socket connector or panel bushing for electric circuits." K. J. Arnold. October 13th, 1923. (230,894.)

31,587. "Wireless circuits." C. H. Roddis. December 17th, 1923. (230,901.)

31,601. "Screening of electric circuits." G. E. Bairsto and F. G. Haydon. December 17th, 1923. (230,902.)

31,670. "Control of reception in radio telephony." J. S. Pringle and C. B. Irvine. December 18th, 1923. (230,904.)

31,751. "Electric driving gear for actuating cash registers and the like." A. J. H. Hadden (National Cash Register Co.). December 18th, 1923. (230,908.)

31,795. "Means for regulating direct-current electric machines." Siemens-Schuckertwerke Ges. December 23rd, 1922. (209,067.)

31,867. "Submarine cables." W. S. Smith and A. D. Shuter. December 19th, 1923. (230,918.)

31,947. "Electrolytic refining of aluminium." Aluminum Co. of America. December 21st, 1922. (208,713.)

31,988. "High-frequency telephone systems." S. Turner. December 20th, 1923. (230,928.)

32,075. "Laminated cores of electrical machines." English Electric Co., Ltd., and A. D. Sloan. December 21st, 1923. (230,932.)

32,098. "Sound-reproducing apparatus." J. Skinderviken and Milvo, Ltd. December 21st, 1923. (230,933.)

32,103. "Electron discharge devices." British Thomson-Houston Co., Ltd. December 21st, 1922. (208,729.)

32,148. "Control apparatus for electrical constant current systems." G. Austin, J. C. Macfarlane, and W. A. Macfarlane. December 22nd, 1923. (230,934.)

1924.

245. "Wireless receiving instruments." T. E. Haywood and T. A. E. Haywood. January 4th, 1924. (230,944.)

1,381. "Electric control apparatus." English Electric Co., Ltd., and E. Morris. January 17th, 1924. (230,952.)

3,300. "Arrangement of wireless receiving apparatus." British Thomson-Houston Co., Ltd., A. P. Young, J. H. Butcher, and A. T. Stace. February 8th, 1924. (230,962.)

3,855. "Construction of electric coils." English Electric Co., Ltd., and P. Beringer. February 14th, 1924. (230,964.)

5,139. "Electrical condensers." Telegraph Condenser Co., Ltd., S. G. Brown, and W. J. Cole. February 28th, 1924. (230,978.)

5,220. "Electrical transformers." W. A. Appleton and J. Joseph. February 29th, 1924. (230,981.)

6,903. "Variable electric condensers." H. A. Yoward. March 18th, 1924. (230,993.)

9,147. "Inductance coils and devices." India Rubber, Gutta Percha and Telegraph Works Co., Ltd., and W. G. Spinks. April 10th, 1924. (231,003.)

9,965. "Method of and means for connecting an auxiliary transformer to an electric circuit." Siemens-Schuckertwerke Ges. April 23rd, 1923. (214,988.)

11,098. "Electric transforming apparatus." English Electric Co., Ltd., and R. M. Charley. May 5th, 1924. (231,025.)

12,102. "Motor iron for electricity meters." Landis & Gyr Soc. Anon. June 22nd, 1923. (217,889.)

12,927. "Automatic electrical cut-outs." E. Adams and A. H. McAuley. May 26th, 1924. (231,040.)

13,215. "Leading-in devices for wireless telegraphic or telephonic receiving sets." C. Pressland. May 29th, 1924. (231,042.)

13,249. "Adjusting device for wireless apparatus." H. Rooke. May 29th, 1924. (231,043.)

13,525. "Coil-holders for wireless tuning coils." Fuller's United Electric Works, Ltd., and A. P. Welch. June 2nd, 1924. (231,044.)

14,050. "Synchronising of induction motors." Siemens-Schuckertwerke Ges. June 9th, 1923. (217,248.)

16,515. "Starting devices for induction motors fed from synchronous phase converters." K. Von Kando. May 28th, 1924. (231,057.)

17,153. "Electric welding." F. B. Dehn (E. G. Budd Manufacturing Co.). July 17th, 1924. (231,060.)

17,220. "Insulation against damp for the outgoing connections of electric switches." A. Egli, jun. July 18th, 1924. (231,062.)

17,281. "Adjustable carriers for electric accumulators and for the like receptacles for various purposes." J. Bate and C. A. Vandervell & Co., Ltd. July 18th, 1924. (231,063.)

19,554. "Electrically-propelled railway vehicles." Metropolitan-Vickers Electrical Co., Ltd. September 22nd, 1923. (222,091.)

22,431. "Electric thermal switches." International General Electric Co., Inc. September 27th, 1923. (222,479.)

23,439. "Variable machine for winding inductance coils as applied to wireless telephony receiving instruments." T. S. R. Milnes. October 8th, 1924. (231,089.)

23,593. "Electric resistance furnace." B. M. S. Kalling. October 9th, 1924. (231,090.)

25,000. "Electrical switches and operating mechanism therefor." F. W. Cox. December 21st, 1923. (Divided application on 32,027/23.) (231,096.)

25,141. "Motor suspension systems for electric locomotives and other electrically-propelled vehicles." Metropolitan-Vickers Electrical Co., Ltd. October 24th, 1923. (223,916.)

1925.

5,001. "Electrically-driven fans." Soc. Rateau. February 23rd, 1924. (229,708.)

"More Light" Campaign.—On March 25th and 26th lectures were given by Mr. W. E. Bush, manager, E.L.M.A. Lighting Service Bureau, at Newcastle-on-Tyne. On the first morning there was an attendance of nearly 100, and Mr. Bush specially talked to members of the industry generally. During the evening a lecture was given on shop lighting to an attendance of over 300, and the local Press inserted comprehensive reports of the lecture. Mr. W. A. Allan (of Messrs. Bainbridge's) presided. On the next evening a lecture on modern electric lighting was given, and the hall was filled with an audience of between 400 and 500 persons. The lecture was illustrated with lantern slides, and created considerable discussion amongst the audience, who showed their appreciation of the demonstration and arguments put before them by the lecturer. A strong feeling was expressed that the North-East Coast should have a Lighting Service Bureau, similar to the one at London, installed in Newcastle-on-Tyne. A local committee was set up to consider the matter.